

USEPA

RCRA FACILITY INVESTIGATION
PHASE II INTERIM TECHNICAL MEMORANDUM

Safety-Kleen Corporation
Chicago Recycle Center
Cook County, Illinois
USEPA ID No. ILD005450697
IEPA ID No. 0316000053

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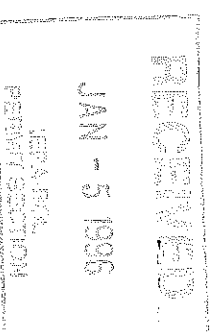
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INTRODUCTION

This Phase II Interim Technical Memorandum was prepared by LTI Environmental Engineering (LTI) on behalf of Safety-Kleen Corporation (Safety-Kleen) to document the results of the first part of the soil and groundwater investigations conducted in September, 1995 as part of the Phase II RCRA Facility Investigation (RFI) for the Safety-Kleen Chicago Recycle Center (SK-CRC) (USEPA ID No. ILD005450697, IEPA ID No. 0316000053). Based on the results of the September, 1995 soil and groundwater investigations, and as specified in Section 6.1 of the approved March 31, 1995 Phase II RCRA Facility Investigation Work Plan, this technical memorandum also proposes additional soil sampling and monitoring well locations for Illinois Environmental Protection Agency (IEPA) review and approval.

The following sections of this Memorandum present an overview of the September, 1995 field investigations, the results of the September, 1995 soil and groundwater investigations, evaluations of the soil and groundwater results, and a proposal for additional field activities (including approved and proposed investigations).

OVERVIEW OF SEPTEMBER, 1995 FIELD INVESTIGATIONS

The first part of the Phase II field investigations was conducted September 13 through 15, 1995 in accordance with the procedures in the approved Phase II Work Plan, and consisted of soil and groundwater investigations with a geoprobe sampling device. The purpose of the investigations was to further determine the extent and distribution of chemicals in soil and groundwater in the vicinity of the areas of concern at the facility. Onsite screening of groundwater samples was conducted with a gas chromatograph (GC). Soil samples were collected from 10 locations with a geoprobe device and submitted to IEA Laboratories (IEA) for volatile organic compound (VOC), semi-volatile organic compound (SVOC) and Total Phenols analyses. Groundwater samples were collected from nine of the ten locations for onsite screening of selected VOCs. All additional groundwater samples were submitted to IEA for VOC and SVOC/Total Phenols analyses. In addition, two soil samples were submitted to Professional Services, Inc. (PSI) for laboratory permeability testing.

During the soil and groundwater extent and distribution investigations in September, 1995, there were several locations where field personnel were unable to collect a full set of soil and/or groundwater samples for laboratory analyses due to subsurface obstructions or a lack of groundwater. A total of eleven locations were investigated (the Work Plan states that 8 to 12 locations would be investigated). Attachment A contains a map depicting the sampling locations and contains a table summarizing the types of samples that were obtained at each location.

At five of the eleven locations, a full sample set was collected for both soil and groundwater. These locations included GP3, GP6, GP7, GP8 and GP9. An SVOC groundwater sample was not collected at location GP1 because sufficient sample volume was not achievable due to very low flow rates. No groundwater was collected for either screening or laboratory analyses at location GP2 because no water was encountered. Deep soil samples from the clay layer were not

collected at locations GP4 and GP5 because a subsurface obstruction was encountered at 4 feet below grade. Field personnel were unable to collect either soil or groundwater samples at one location only (GP11), because of a lack of water down to 12 feet below grade and because the geoprobe device broke at this location.

RESULTS OF SEPTEMBER, 1995 SOIL AND GROUNDWATER INVESTIGATIONS

The tabulated soil analytical results for the September, 1995 and a map depicting compounds detected in soils are presented in Attachment B. All detected soil analytes are highlighted with bold font in the summary table provided in Attachment B. The September, 1995 groundwater field screening results and groundwater laboratory analytical data are summarized in separate tables in Attachment C. All detected groundwater analytes are highlighted with bold font in the laboratory analytical data summary table provided in Attachment C. In addition, a map depicting compounds detected in groundwater is presented in Attachment C. The IEA laboratory data summary reports for the soil and groundwater analyses are provided in Attachments D and E, respectively. Complete laboratory report packages (with QA/QC documentation) will be provided to IEPA in the final Phase II RFI Report, but have not been provided herein because of the voluminous nature of the raw QA/QC data.

The laboratory permeability test results for geoprobe soil samples GP6 (5.5-7 feet) and GP8 (6-8 feet) are 1.0×10^{-7} cm/sec and 7.22×10^{-8} cm/sec, respectively (refer to Attachment F for the PSI laboratory report). These two soil samples are described as wet, very soft, black, organic silty clay, with some fine to coarse sand and trace gravel.

EVALUATION OF SEPTEMBER, 1995 INVESTIGATION RESULTS

As specified in Item #1 in the July 7, 1995 IEPA qualified approval letter to the Phase II Work Plan, the objectives of the RFI are to delineate the extent of contamination in the areas in the vicinity of Container Storage Area #1, the area in the vicinity of Tank Farms #2 and #3, and at Tanks T-190 through T-193. The results of the first part of the Phase II RFI indicate that the vertical extent of chemicals detected in soils is defined for the entire area of investigation. The horizontal extent of chemicals in soil and groundwater is confirmed on the western and southwestern sides of the area of investigation. The first part of the geoprobe investigation results provide further characterization in other areas of the site, and additional soil borings/monitoring wells are proposed in this Memorandum to confirm the horizontal extent of chemicals in soil and groundwater on the northern, eastern and southern sides of the area of investigation.

The 1995 soil and groundwater results are evaluated in greater detail in the following paragraphs.

Evaluation of September, 1995 Soil Analytical Results

The soil laboratory data indicate that twenty of the thirty-six VOC analytes were detected above PQLs in one or more of the twenty soil samples submitted to IEA. Total phenols were detected in all twenty soil samples and fifteen of the sixteen SVOC analytes were detected above PQLs in one or more of the twenty soil samples submitted to IEA.

Ten of the detected VOCs have Preliminary Soil Target Limits (PSTLs), as designated in the July 7, 1995 qualified approval letter to the Phase II Work Plan. Of these ten detected VOCs with designated PSTLs, only four compounds (vinyl chloride, TCE, benzene and ethylbenzene) exceeded the designated PSTLs. None of the phenol detections exceeded the designated PSTL for total phenols (49,000 ug/kg). Seven of the detected SVOCs exceeded the designated PSTLs (benzo (a) anthracene, chrysene, benzo (b) fluoranthene, benzo (k) fluoranthene, benzo (a) pyrene, indeno (1,2,3-cd) pyrene and total acenaphthylene/phenanthrene/benzo(g,h,i) perylene). Compounds detected above PSTLs are highlighted with an outline in the table and figure provided in Attachment B, and are summarized in Table I.

The 1995 soil analytical data indicate that the vertical extent of chemicals detected in soils is confirmed throughout the area of investigation. Compounds detected above designated PSTLs are limited to the shallow soil samples (less than 5 feet below grade). Only low concentrations of two VOCs were detected in the clay samples collected between 12 and 17 feet below grade (methylene chloride and acetone at less than or equal to 240 ug/kg and 34 ug/kg, respectively). Only low concentrations of four SVOCs were detected in the clay samples collected between 12 and 17 feet below grade (benzo (a) anthracene, benzo (b) fluoranthene, benzo (k) fluoranthene and benzo (a) pyrene at less than or equal to 68 ug/kg, 64 ug/kg, 27 ug/kg and 73 ug/kg, respectively). None of the deep soil samples that were collected from the basal clay (greater than 12 feet below grade) had levels of SVOCs or phenols above designated PSTLs.

The 1995 soil analytical data confirm that the horizontal extent of chemicals in soil is defined on the western and southwestern sides of the area of investigation and appears to be defined on the northern side of the site. No VOCs were detected in any of the soil samples collected in the alley along the western side of the area of investigation (between the SK-CRC and Ashland Cold Storage), with the exception of methylene chloride and acetone in GP7 and methylene chloride in GP8. The alley between the SK-CRC and Ashland Cold Storage is asphalted, which may explain the presence of several SVOCs in the shallow soil samples collected from the GP7 and GP8 locations. Alternatively, prior to paving, the alley may have been a dirt road that was oiled for dust control. (The deep soil samples collected from GP7 and GP8 locations did not contain detectable levels of SVOCs). Along the northern side of the area of investigation at the GP10 location, only low concentrations were detected of three VOCs (methylene chloride at 21 ug/kg, acetone at 79 ug/kg and 2-butanone at 21 ug/kg) and four SVOCs (benzo (a) anthracene at 46 ug/kg, benzo (b) fluoranthene at 59 ug/kg, benzo (k) fluoranthene at 15 ug/kg and benzo (a) pyrene at 45 ug/kg).

Four additional soil borings are proposed in this Memorandum to confirm the horizontal extent of VOCs and SVOCs in soil along the northern, eastern and southeastern sides of the area of investigation (see Additional Field Activities section below). The soil permeability results are consistent with previous characterizations of the saturated soils at the site; therefore, no additional laboratory permeability testing or in-situ hydraulic conductivity testing is proposed in this Memorandum.

Evaluation of September, 1995 Groundwater Analytical Results

The groundwater laboratory data indicate that twenty of the thirty-eight VOC analytes were detected above PQLs in one or more of the nine groundwater samples submitted to IEA. Thirteen of the thirty-three SVOC analytes were detected above PQLs in one or more of the nine groundwater samples submitted to IEA.

Eleven of the detected VOCs have Class II Groundwater Standards. Of these eleven compounds, eight were detected above their respective Class II Groundwater Standards (vinyl chloride, cis-1,2-DCE, 1,2-DCA, 1,1,1-TCA, TCE, PCE, benzene and toluene). Only one SVOC (phenol) has a designated Class II Groundwater Standard. Phenol was not detected above the Class II Groundwater Standard (100 ug/l) in any of the September, 1995 groundwater samples submitted to IEA. The VOC and SVOC compounds detected in the September, 1995 groundwater samples above designated Class II Groundwater Standards are highlighted with an outline in the table and figure provided in Attachment C, and are summarized in Table 2.

The 1995 groundwater analytical data confirm that the horizontal extent of chemicals in groundwater is defined on the western and southwestern sides of the area of investigation and indicate horizontal limits on the southern and northern sides of the area of investigation. Along the western side, no VOCs or SVOCs were detected in groundwater samples collected in the alley between the SK-CRC and Ashland Cold Storage at the GP7 and GP8 locations, with the exception of 10 ug/l tetrahydrofuran and 21 ug/l bis (2-ethylhexyl) phthalate in the GP7 water sample. On the southern side of the property, at the GP1 location, only 24 ug/l acetone and 19 ug/l tetrahydrofuran were detected. No SVOC samples was collected at this location because of very slow recharge. On the northern side of the property, the groundwater screening results for the GP10 sample did not have detectable levels of VOCs for the eleven analytes measured in the field (refer to Attachment C).

Four additional monitoring wells are proposed in this Memorandum to confirm the extent of VOCs and SVOCs in groundwater along the northern, eastern and southeastern sides of the area of investigation (see Additional Field Activities section below).

PROPOSED ADDITIONAL FIELD ACTIVITIES

Future field activities will consist of the three remaining tasks described in the approved Phase II Work Plan plus two additional tasks proposed in this Memorandum for IEPA review and approval. The two proposed additional tasks are: (1) installation of four soil borings/monitoring wells; and (2) sampling of the four new monitoring wells for water quality data. The three remaining approved tasks are: (1) installation of two piezometers; (2) surveying; and (3) static water level monitoring. The additional soil boring/monitoring well locations proposed in this section are selected to supplement the gaps in the existing groundwater data set, and to provide information along the northern and eastern boundaries of the area of investigation. These proposed locations will be finalized subject to approval by the IEPA. The proposed soil boring

locations will provide confirmatory soil quality data. The proposed wells will provide data to better define groundwater flow directions and confirm the horizontal extent of groundwater impacts at the site. The two proposed new tasks and the three approved tasks are described in more detail as follows:

- **Proposed Installation of Four Additional Soil Borings/Monitoring Wells** - As stipulated in the Phase II Work Plan, based on the results of the extent and distribution investigations, additional soil borings/monitoring wells are proposed for IEPA review and approval. Figure 1 depicts the locations of the four proposed soil borings/monitoring wells (designated as SB11/MW11, SB12/MW12, SB13/MW13 and SB14/MW14). The additional proposed soil borings/monitoring wells will be installed at the time the two piezometers are installed, in accordance with the procedures described in Section 6.1.2 of the approved Phase II Work Plan. These procedures include soil sampling for physical and laboratory data. Continuous split spoon sampling would be conducted to characterize the lithology and to collect samples for confirmatory laboratory analysis.

At each location, soil samples will be collected from the unsaturated zone and clay interval will be used for physical characterization and laboratory analyses. Two discrete soil samples will be collected for laboratory analysis from the unsaturated interval in each borehole (located above approximately 3 to 5 feet below grade). Soil samples will be collected continuously from the saturated interval for physical characterization only using two-foot long split spoon samplers. The saturated interval is present at the site between approximately 10 to 13 feet below grade and above the clay layer. Upon reaching the top of the clay interval, the hollow stem augers would be advanced approximately two feet into the clay to collect one clay sample for physical characterization only (rather than laboratory analysis, as stated in the Phase II Work Plan), because the vertical extent of chemicals in soil has been defined.

Soil samples will be submitted to IEA for VOC and SVOC laboratory analyses. IEPA's September 30, 1994 response to the Phase I RFI Report requested that the Phase II RFI include specific analyses for VOCs and polynuclear aromatic compounds (PNAs) for any soil samples intended to demonstrate the boundary of impacts. These analytes and preliminary target levels requested by IEPA are summarized in Table 7 of the Phase II Work Plan. Soils analyses at the laboratory will follow SW846 Methods 8240 for VOCs and 8270 or 8310 for SVOCs.

The preliminary soil target levels listed in Table 7 of the Phase II Work Plan will serve as criteria for determining the extent of soil sampling/analysis necessary during the RFI, as stated by IEPA in their September 30, 1994 response to the Phase I RFI Report. Final cleanup objectives to determine the need for and extent of soil remediation will be established after the RFI is complete. The laboratory analyses listed above will be conducted in accordance with the procedures presented in the QAPP for IEA (see Attachment A of the Phase II Work Plan).

Monitoring wells will be installed in each of the four proposed borehole locations to a depth just above the clay layer (approximately ten feet below grade) as allowed by subsurface conditions. The procedures for monitoring well installation are described in Section 6.1.2 of the Phase II Work Plan, and are consistent with the procedures used to

install and construct the existing site wells. All four of the new wells will be developed after installation to remove fine-grained materials, according to procedures described in the approved Phase II Work Plan.

- **Proposed Sampling of the Four New Monitoring Wells for Water Quality Data** - No sooner than one week after the proposed new monitoring wells are installed and developed, groundwater samples will be collected from each of the four new monitoring wells according to the procedures recommended by IEPA in their September 23, 1993 response to the Phase I Work Plan (see Attachment D of the approved Phase II Work Plan). Groundwater samples will be analyzed at IEA for the list of organic analytes and practical quantitation limits (PQLs) summarized in Table 6 of the approved Phase II Work Plan. Groundwater analyses at the laboratory will follow SW846 Methods 8240 for VOCs and 8270 for SVOCs. The PQLs listed in Table 6 of the Phase II Work Plan will be achieved when possible; however, it is possible that matrix interference's and dilution's may necessitate higher reporting limits.

- **Installation of Piezometers (as Described in the Approved Phase II Work Plan)** - As stipulated in the Phase II Work Plan, two piezometers will be installed adjacent to existing piezometers P1 and P2 in the vicinity of former Tank Farm #3 to determine the presence and influence, if any, of vertical groundwater gradients at the site. The piezometers will be installed in accordance with the procedures outlined in Section 6.1.3 of the approved Phase II Work Plan.
- **Surveying (as Described in the Approved Phase II Work Plan)** - After the two piezometers and additional proposed monitoring wells are installed, the top of casing and ground level elevations will be surveyed relative to the existing site wells. In addition, reconstructed monitoring well MW8 will be resurveyed at this time, as stated in the October 75, 1995 First Quarterly Report for the Phase II activities.
- **Collect Quarterly Static Water Level Data (as Described in the Approved Phase II Work Plan)** - As stipulated in Section 6.1.5 of the approved Phase II Work Plan, after the two piezometers and additional proposed monitoring wells are installed, static water level data will be collected from all site wells quarterly for one year.

REPORTING

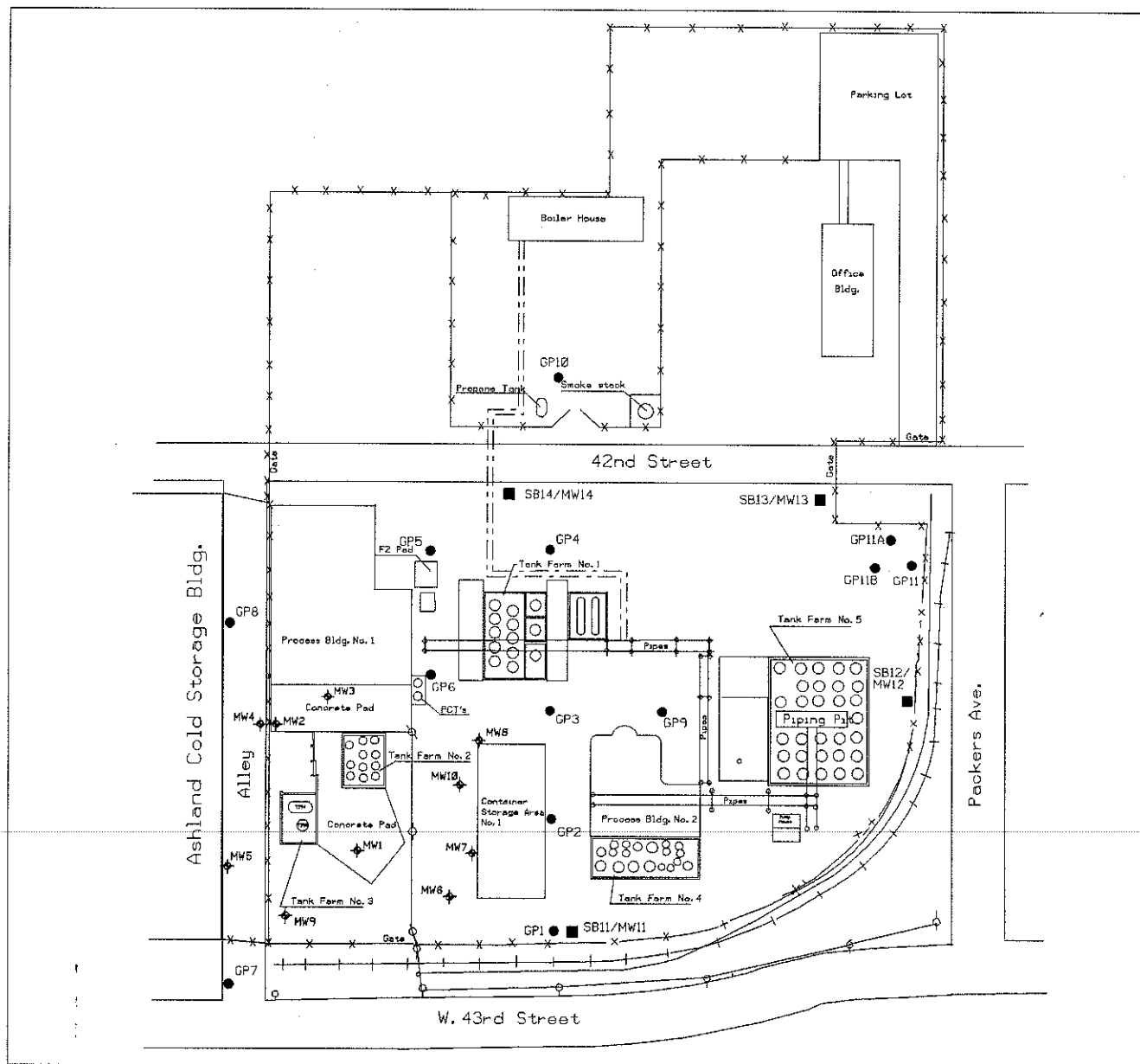
As outlined in Section 7 of the approved Phase II Work Plan, a Phase II Report will be submitted to IEPA within six months after all additional monitoring wells/piezometers are installed. The Phase II report will summarize the investigation tasks, deviations from specified procedures (if any), all data collected, the quality assurance review, data evaluations, and findings of the Phase II RFI. The Phase II report and laboratory analyses will be certified by personnel in accordance with 35 IAC 702.126 (see Attachment G of the Phase II Work Plan).

TABLE 1. Summary of Compounds Detected in September, 1995 Soil Samples Above Designated Preliminary Soil Target Levels, Safety-Kleen Chicago Recycle Center

<u>Compound Detected >PSTL</u>	<u>PSTL (ug/kg)</u>	<u>Occurrence</u>
Vinyl Chloride	2	GP2 (2'-4') @ 440 ug/kg
TCE	20	GP1 (2'-3') @ 190 ug/kg GP2 (2'-4') @ 2200 ug/kg
Benzene	20	GP2 (2'-4') @ 40 ug/kg GP5 (2'-4') @ 56 ug/kg GP6 (2'-4') @ 250 ug/kg
Ethylbenzene	5000	GP5 (2'-4') @ 7300 ug/kg
Benzo (a) anthracene	700	GP1 (2'-3') @ 13000 ug/kg GP2 (2'-4') @ 1400 ug/kg GP7 (2'-4') @ 730 ug/kg GP8 (2'-4') @ 5400 ug/kg GP9 (2'-4') @ 2500 ug/kg
Chrysene	1000	GP1 (2'-3') @ 13000 ug/kg GP2 (2'-4') @ 1500 ug/kg GP8 (2'-4') @ 6100 ug/kg GP9 (2'-4') @ 3000 ug/kg
Benzo (b) fluoranthene	900	GP1 (2'-3') @ 9300 ug/kg GP2 (2'-4') @ 1200 ug/kg GP8 (2'-4') @ 3600 ug/kg GP9 (2'-4') @ 2100 ug/kg
Benzo (k) fluoranthene	4000	GP1 (2'-3') @ 5900 ug/kg
Benzo (a) pyrene	90	GP1 (2'-3') @ 12000 ug/kg GP2 (2'-4') @ 1700 ug/kg GP4 (2'-4') @ 160 ug/kg GP5 (2'-4') @ 360 ug/kg GP7 (2'-4') @ 970 ug/kg GP8 (2'-4') @ 6100 ug/kg GP9 (2'-4') @ 2900 ug/kg
Indeno (1,2,3-c,d) Pyrene	900	GP1 (2'-3') @ 7400 ug/kg GP2 (2'-4') @ 1100 ug/kg GP8 (2'-4') @ 3600 ug/kg GP9 (2'-4') @ 1800 ug/kg
Acenaphthylene/Phenanthrene/ Benzo (g,h,i) Perylene (total)	21000	GP8 (2'-4') @ 3400, 53000 and 4300 ug/kg, respectively

TABLE 2. Summary of Compounds Detected in September, 1995 Groundwater Samples Above Designated Class II Groundwater Standards, Safety-Kleen Chicago Recycle Center

<u>Compound Detected >Class II Standard</u>	<u>Class II Standard (ug/l)</u>	<u>Occurrence</u>
Vinyl Chloride	10	GP3 @ 60 ug/l GP6 @ 14 ug/l GP9 @ 55 ug/l
Cis-1,2-Dichloroethylene	200	GP3 @ 1200 ug/l
1,2-Dichloroethane	25	GP9 @ 66000 ug/l
1,1,1-Trichloroethane	1000	GP9 @ 30000 ug/l
Trichloroethylene	25	GP9 @ 6600 ug/l
Perchloroethylene	25	GP9 @ 3700 ug/l
Benzene	25	GP5 @ 100 ug/l GP6 @ 1900 ug/l
Toluene	2500	GP6 @ 7500 ug/l GP9 @ 6400 ug/l



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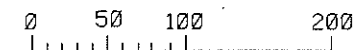
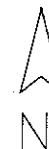
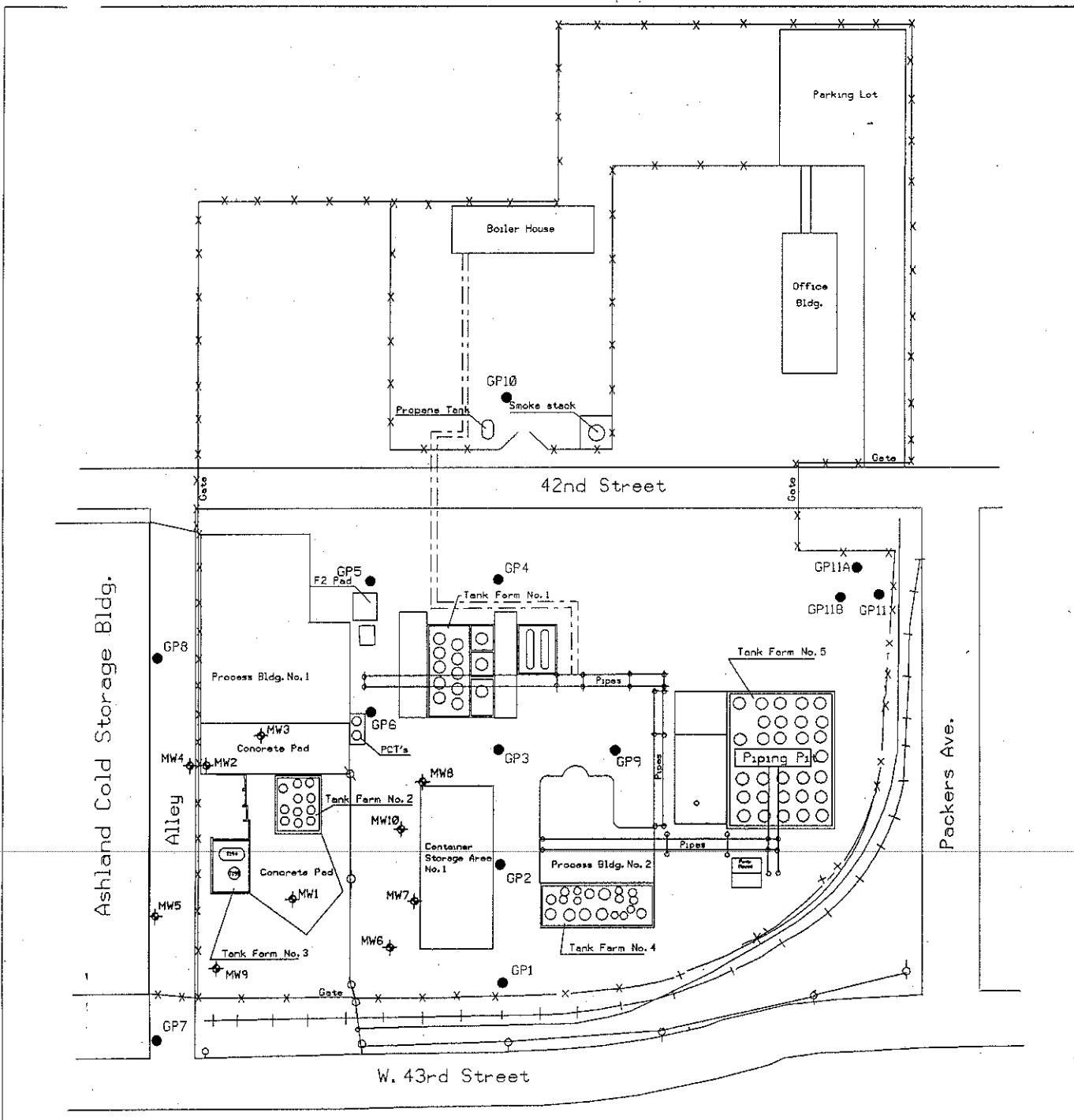
Figure 1
Proposed Soil Boring/
Monitoring Well Locations

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Filename: \skch1\maps\sitemap.dgn

Revision Date: 11/18/95

Attachment A
September, 1995 Geoprobe Sampling Locations and Summary of
September, 1995 Sample Collections and Analyses, Phase II Investigations



Legend

- Building or Street Outline
- Concrete Pad
- Overhead Line or Pipe
- x - Fenceline
- ✕ MW Monitoring Well
- GP Geoprobe Sampling Location

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Geoprobe Sampling
Locations
September 1995

 **LTI-Limno-Tech, Inc.**
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SUMMARY OF SEPTEMBER, 1995 SAMPLE COLLECTIONS AND ANALYSES, PHASE II INVESTIGATIONS **Safety-Kleen Chicago Recycle Center**

Geoprobe Location	Interval (feet)	Field Screening Sample	Lab VOC Analysis	Lab SVOC/Phenols Analyses	Permeability Test	Geoprobe Location	Interval (feet)	Field Screening Sample	Lab VOC Analysis	Lab SVOC/Phenols Analyses	Permeability Test
GP1	2'-3' (soil)		x	x		GP7	2'-4' (soil)		x	x	
	14'-16' (soil)		x	x			13'-15' (soil)		x	x	
	9'-11' (water)	x	x				11'-13' (water)	x	x	x	
GP2	2'-4' (soil)		x	x		GP8	2'-4' (soil)		x	x	
	15'-17' (soil)		x	x			13'-15' (soil)		x	x	
	no water						6'-8' (soil)				x
GP3	2'-4' (soil)		x	x			4'-6' (water)	x (2'-4')	x	x	
	14'-16' (soil)		x	x		GP9	2'-4' (soil)		x	x	
	7'-9' (water)	x	x	x			14'-16' (soil)		x	x	
GP4	2'-4' (soil)		x	x			9'-11' (water)	x (11'-13')	x	x	
	hit obstruction, no soil sample below 4'					GP10	2'-4' (soil)		x	x	
	2'-4' (water)	x	x	x			12'-14' (soil)		x	x	
GP5	2'-4' (soil)		x	x			10'-12'	x			
	hit obstruction, no soil sample below 4'					GP11	no soil				
	2'-4' (water)	x	x	x			no water (dry to 12', geoprobe broke)				
GP6	2'-4' (soil)		x	x		DUP-F	soil (GP7: 2'-4')		x	x	
	13'-15' (soil)		x	x		DUP-G	water (GP7: 11'-13')		x	x	
	5.5'-7' (soil)				x						
	2'-4' (water)	x	x	x							

Attachment B.
Table of Validated Soil Analytical Results (September 13-15, 1995) and
Map of Compounds Detected in Soils (September, 1995)

1 Loose Lab Sheet provided by IEA, Schaumburg, IL October 3, 1995
PQL Practical Quantitation Limit
Flag data qualifier
U Compound was not detected at or above the reporting limit
E* Sample was diluted due to exceeding detection level, the concentration used here is the highest among each run
* Concentration used here is the value after dilution although no "E" which represents exceeding the PQL was labelled.
^ sum of the three PNAs: Acenaphthylene, Benzo (g,h,i) perylene, Phenanthrene
na not available
Concentrations exceed Preliminary Soil Target Levels specified in Item 3 of IEPA qualified approval letter to Phase II Workplan (7/7/95)

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PERMIT SECTION

1 Loose Lab Sheet provided by IEA, Schaumburg, IL October 3, 1995
PQL Practical Quantitation Limit
Flag data qualifier
U Compound was not detected at or above the reporting limit
E* Sample was diluted due to exceeding detection level, the concentration used here is the highest among each run
* Concentration used here is the value after dilution although no "E" which represents exceeding the PQL was labelled.
^ sum of the three PNAs: Acenaphthylene, Benzo (g,h,i) perylene, Phenanthrene
na not available
Concentrations exceed Preliminary Soil Target Levels specified in Item 3 of IEPA qualified approval letter to Phase II Workplan (7/7/95)

GP8	2'-4'	13'-15'
(ug/Kg)	9/14/95	9/14/95
MC	120	26J
NPHTHL	8500	nd660
ACNPHTH	3400	nd660
Fluorene	1700	nd140
PHNTH	53000	nd660
Anthracene	3700	nd660
FLRTH	18000	nd660
Pyrene	15000	nd180
B (a) A	5400	nd8.7
Chrysene	5100	nd100
B (b) F	3600	nd11
B (k) F	2300	nd11
B (a) P	6100	nd15
I(1,2,3-cd)P	3600	nd29
B (g,h,i) P	4300	nd51
Phenols	2300	<600

GP3	2'-4'	14'-16'
(ug/Kg)	9/13/95	9/13/95
MC	56	59J
Acetone	52	23J
2-Butanone	14	nd10
Benzene	20	nd5
Toluene	240	nd5
EB	27	nd5
Xylenes	55	nd5
B (a) A	nd8.7	26
B (b) F	nd11	64
B (k) F	nd11	27
Phenols	620	4000

GP2	2'-4'	2'-4' dup	15'-17'
(ug/Kg)	9/13/95	9/13/95	9/13/95
VC	14	440	nd2
CA	nd10	61	nd10
MC	38	690	nd5
Acetone	nd10	nd10	29J
CD	nd5	23	nd5
1,1-DCE	nd5	28	nd5
1,1-DCA	56	2100	nd5
cis-1,2-DCE	120	2200	nd5
trans-1,2-DCE	nd5	60	nd5
CF	nd5	7	nd5
1,2-DCA	nd5	6	nd5
1,1,1-TCA	24	2400	nd5
TCE	24	2200	nd5
1,1,2-TCA	nd5	9J	nd5
Benzene	nd5	40J	nd5
PCE	58	5600	nd5
Toluene	nd5	14J	nd5
Xylenes	nd5	7J	nd5
NPHTHL	2000	1300	nd660
Fluorene	200	160	nd140
PHNTH	2400	1500	nd660
Anthracene	770	nd660	nd660
FLRTH	2700	2400	nd660
Pyrene	2900	2300	nd180
B (a) P	1400	970	32
Chrysene	1500	1300	nd100
B (b) F	1200	950	16
B (k) F	670	590	12
B (a) P	1700	1300	nd15
I(1,2,3-cd)P	1100	960	nd29
B (g,h,i) P	1400	1300	nd51
Phenols	660	<560	<590

GP7	2'-4'	2'-4' dup	13'-15'
(ug/Kg)	9/14/95	9/14/95	9/14/95
MC	45	240J	32J
Acetone	nd10	nd10	21
NPHTHL	2600	nd660	nd660
PHNTH	1700	nd660	nd660
FLRTH	1700	nd660	nd660
Pyrene	670	nd180	nd180
B (a) A	730	68	nd8.7
Chrysene	510	nd100	nd100
B (b) F	330	32	nd11
B (k) F	230	17	nd11
B (a) P	970	73	nd15
I(1,2,3-cd)P	450	43	nd29
B (g,h,i) P	660	54	nd51
Phenols	790	18000	<610

GP6	2'-4'	13'-15'
(ug/Kg)	9/14/95	9/14/95
CA	260	nd10
MC	97	36J
Acetone	130	34J
1,1-DCA	11	nd5
2-Butanone	30	nd10
Benzene	250	nd5
Toluene	2400	nd5
EB	8	nd5
Xylenes	12	nd5
B (a) A	21	32
B (b) F	25	nd11
B (k) F	15	nd11
B (a) P	50	18
I(1,2,3-cd)P	45	nd29
Phenols	<630	2400

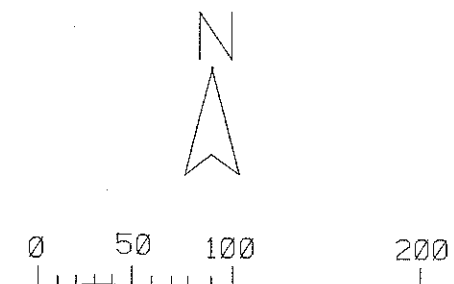
GP5	2'-4'
(ug/Kg)	9/14/95
MC	9
Acetone	29
Benzene	56
EB	7300
Xylenes	12000
NPHTHL	1300
Pyrene	550
B (a) A	250
B (b) F	190
B (k) F	110
B (a) P	350
I(1,2,3-cd)P	200
B (g,h,i) P	470

GP10	2'-4'	12'-14'
(ug/Kg)	9/15/95	9/15/95
MC	nd5	21
Acetone	79	nd10
2-Butanone	21	nd10
B (a) A	46	31
B (b) F	22	59
B (k) F	15	14
B (a) P	45	21
Phenols	<620	<600

GP4	2'-4'
(ug/Kg)	9/14/95
MC	21
Acetone	46
Toluene	34
NPHTHL	860
Pyrene	370
B (a) A	180
B (b) F	110
B (k) F	63
B (a) P	160
I(1,2,3-cd)P	86
B (g,h,i) P	85
Phenols	<600

GP9	2'-4'	14'-16'
(ug/Kg)	9/14/95	9/14/95
MC	51	13J
Acetone	130	21J
2-Butanone	21	nd10
NPHTHL	5100	nd660
ACNPHTH	5100	nd1200
Fluorene	240	nd140
PHNTH	3800	nd660
Anthracene	1200	nd660
FLRTH	5800	nd660
Pyrene	5300	nd180
B (a) A	2500	nd8.7
Chrysene	3000	nd100
B (b) F	2100	nd11
B (k) F	1300	nd11
B (a) P	2900	nd15
I(1,2,3-cd)P	1800	nd29
B (g,h,i) P	2000	nd5
Phenols	4300	<600

GP1	2'-3'	14'-16'
(ug/Kg)	9/13/95	9/13/95
MC	44	34
Acetone	nd10	14
1,1-DCA	71	nd5
cis-1,2-DCE	40	nd5
1,1,1-TCA	160	nd5
TCE	190J	nd5
PCE	260J	nd5
Toluene	10J	nd5
Xylenes	6J	nd5
NPHTHL	16000	nd660
FLRTH	30000	nd660
Pyrene	34000	nd180
B (a) A	13000	27
B (b) F	9300	nd11
B (k) F	5900	nd11
B (a) P	12000	19
I(1,2,3-cd)P	7400	nd29
B (g,h,i) P	8300	nd51
Phenols	630	<600



Legend	
—	Building or Street Outline
—	Concrete Pad
—	Overhead Line or Pipe
-X-X-	Fenceline
- - -	Concentration exceeds Preliminary Soil Target Levels (ug/kg)

Chemical:	Preliminary Soil Target Levels:
VC: Vinyl Chloride	2
CA: Chloroethane	
MC: Methylene Chloride	
Acetone	
CD: Carbon Disulfide	
1,1-DCE: 1,1-Dichloroethene	30
1,1-DCA: 1,1-Dichloroethane	
cis-1,2-DCE: cis-1,2-Dichloroethene	
trans-1,2-DCE: trans-1,2-Dichloroethene	
CF: Chloroform	200
1,2-DCA: 1,2-Dichloroethane	10
1,1,1-TCA: 1,1,1-Trichloroethane	
TCE: Trichloroethene	20
1,1,2-TCA: 1,1,2-Trichloroethane	10
Benzene	20
PCE: Tetrachloroethene	
Toluene	5000
EB: Ethylbenzene	5000
Xylenes	74000
Phenols	49000
PHNTH: Phenanthrene	21000
NPHTHL: Naphthalene	30000
ACNPHTH: Acenaphthene	200000
Fluorene	160000
FLRTH: Fluoranthene	980000
Pyrene	1400000
B (a) A: Benzo (a) Anthracene	700
B (b) F: Benzo (b) Fluoranthene	900
B (k) F: Benzo (k) Fluoranthene	4000
B (a) P: Benzo (a) Pyrene	90
I(1,2,3-cd)P: Indeno (1,2,3-cd) Pyrene	900
B (g,h,i) P: Benzo (g,h,i) Perylene	<21000

SAFETY-KLEEN CORP.
Chicago Recycle Center

Compounds Detected
in Soil
September 1995

LTI-Environmental Engineering
501 Avis Drive, Ann Arbor, MI 48108

Filename: \skchl\maps\sitemap.dgn

Revision Date: 11/10/95

Attachment C.

Table of September, 1995 Groundwater Field Screening Results,
Table of Validated Groundwater Analytical Results (September 13-15, 1995) and
Map of Compounds Detected in Groundwater (September, 1995)

SUMMARY OF SEPTEMBER, 1995 GROUNDWATER FIELD SCREENING RESULTS

Safety-Kleen Chicago Recycle Center

SAMPLE I.D.	GP1	GP3	GP4	GP4-dup	GP5	GP6	GP7	GP8	GP9	GP10
SAMPLING DATE	9/13/95	9/13/95	9/14/95	9/14/95	9/14/95	9/14/95	9/14/95	9/14/95	9/15/95	9/15/95
SAMPLING DEPTH/INTERVAL (ft)	9-11	7-9	2-4	2-4	2-4	2-4	11-13	4-6	11-13	10-12
VOLATILE ORGANICS (µg/L)										
Vinyl Chloride	<5	<50	<5	<5	NA	NA	<5	<5	NA	<5
1,1-Dichloroethene	<2	<20	<2	<2	<2	<2	<2	<2	<200	<2
1,2-Dichloroethene	<2	988	14	12	2	<100	<2	<2	<200	<2
1,1,1-Trichloroethane	<10	<100	<10	<10	<10	<100	<10	<10	88200	<10
Trichloroethene	<1	25	2	<1	6	13	<1	<1	13300	<1
Tetrachloroethene	<1	15	3	<1	<10	<10	<1	<1	15800	<1
Benzene	<1	<10	8	11	84	1260	<1	<1	NA	<1
Ethylbenzene	<2	<20	<2	<2	324	2	<2	<2	33	<2
Toluene	<2	294	105	132	<100	5770	<2	<2	12500	<2
Xylene (total)	<3	<30	<3	<3	311	13	<3	<3	70	<3
Chlorobenzene	<10	<100	<10	<10	NA	<10	<10	<10	<100	<10
Styrene	<10	<100	<10	<10	NA	<10	<10	<10	<100	<10
Tetrahydrofuran	<250	52000	465	522	NA	NA	<250	<250	NA	<250
Trichlorotrifluoroethane	<25	<250	<25	<25	<25	<25	<25	<25	>100000	<25
Notes:		*	*	*	*	*			*	

* Unidentified compounds present

NA Not attainable due to interferences

VALIDATED GROUND WATER ANALYTICAL RESULTS (September 13-15, 1995)
SAFETY-KLEEN CHICAGO RECYCLE CENTER, CHICAGO,IL

SAMPLE I.D.	GP1		GP3		GP4		GP5		GP6		GP7		GP7 (DUP)		GP8		GP9		RINSE BLANK1	RINSE BLANK2		RINSE BLANK3		TRIP BLANK		Class II				
SAMPLING DATE	9/13/95		9/13/95		9/14/95		9/14/95		9/14/95		9/14/95		9/14/95		9/14/95		9/15/95		9/13/95	9/14/95		9/15/95		9/11/95		Standard				
SAMPLING DEPTH/INTERVAL (ft)	9-11		7-9		2-4		2-4		2-4		11-13		11-13		4-6		9-11		9/13/95	9/14/95		9/15/95		9/11/95		(µg/l)				
VOLATILE ORGANICS (µg/L)	PQL	Flag	QL	Flag	QL	Flag	PQL	Flag	PQL	Flag	PQL	Flag	PQL	Flag	PQL	Flag	PQL	Flag	PQL	Flag	PQL	Flag	PQL	Flag	PQL	Flag				
Chloromethane	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	na			
Bromomethane	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	na			
Vinyl Chloride	nd 2	U	60	50	8	2	nd 2	U	14	2	nd 2	U	nd 2	U	nd 2	U	55	2	nd 2	U	nd 2	U	nd 2	U	nd 2	U	10			
Chloroethane	nd 10	U	86	10	64	10	nd 10	U	1200	500	E*	nd 10	U	nd 10	U	nd 10	U	34	10	nd 10	U	nd 10	U	nd 10	U	nd 10	U	na		
Methylene Chloride	nd 5	U	22	5	nd 5	U	nd 5	U	43	5	nd 5	U	nd 5	U	nd 5	U	28000	500	E*	nd 5	U	nd 5	U	nd 5	U	nd 5	U	na		
Acetone	24	10	20	10	160	100	12	10	110	10	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	na			
Carbon Disulfide	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	na			
1,1-Dichloroethene	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	na			
1,1-Dichloroethane	nd 5	U	310	5	E*	62	50	12	5	66	5	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	na		
cis-1,2-Dichloroethene	nd 5	U	1200	5	E*	6	5	8	5	nd 5	U	nd 5	U	nd 5	U	nd 5	U	4300	2500	E*	nd 5	U	nd 5	U	nd 5	U	nd 5	U	35	
trans-1,2-Dichloroethene	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	31	5	nd 5	U	nd 5	U	nd 5	U	nd 5	U	na	
Chloroform	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	8	5	nd 5	U	nd 5	U	nd 5	U	nd 5	U	200	
1,2-Dichloroethane	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	500	
2-Butanone	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 5	U	66000	500	E*	nd 5	U	nd 5	U	nd 5	U	nd 5	U	na
1,1,1-Trichloroethane	nd 5	U	nd 5	U	nd 5	U	nd 5	U	6	5	nd 10	U	nd 10	U	nd 10	U	nd 10	U	22	10	nd 10	U	nd 10	U	nd 10	U	nd 10	U	25	
Carbon Tetrachloride	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	30000	500	E*	nd 5	U	nd 5	U	nd 5	U	nd 5	U	na
Vinyl Acetate	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	1000	
Bromodichloromethane	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	25	
1,2-Dichloropropane	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	na	
trans-1,3-Dichloropropene	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	na	
Trichloroethene	nd 5	U	10	5	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	25	
Dibromochloromethane	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	6600	500	E*	nd 5	U	nd 5	U	nd 5	U	nd 5	U	na
1,1,2-Trichloroethane	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	25	
Benzene	nd 5	U	8	5	19	5	100	5	1900	250	E*	nd 5	U	nd 5	U	nd 5	U	7	5	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	na
cis-1,3-Dichloropropene	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	na	
2-Chloroethylvinylether	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	25	
Bromoform	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	na	
4-Methyl-2-Pentanone	nd 10	U	nd 10	U	nd 10	U	nd 5	U	140	10	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	na	
2-Hexanone	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	na	
Tetrachloroethene	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	na	
1,1,2,2-Tetrachloroethane	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	3700	2500	E*	nd 5	U	nd 5	U	nd 5	U	nd 5	U	na
Toluene	nd 5	U	270	5	E*	170	50	17	5	7500	250	E*	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	25	
Chlorobenzene	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	6400	500	E*	nd 5	U	nd 5	U	nd 5	U	nd 5	U	na
Ethylbenzene	nd 5	U	nd 5	U	nd 5	U	240	5	E*	6	5	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	2500
Styrene	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	27	5	nd 5	U	nd 5	U	nd 5	U	nd 5	U	500	
Total Xylenes	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	1000	
Tetrahydrofuran	19	5	37000	2500	E*	1100	5	52	5	25	5	nd 5	U	nd 5	U	nd 5	U	93	5	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	500
1,1,2-Trichlorotrifluoroethane	nd 10	U	25	10	nd 10	U	nd 10	U	9700	250	E*	10	5	nd 5	U	nd 5	U	16	5	nd 5	U	nd 5	U	nd 5	U	nd 5	U	nd 5	U	10000
																		190000	5000	E	nd 10	U	nd 10	U	nd 10	U	nd 10	U	na	

VALIDATED GROUND WATER ANALYTICAL RESULTS (September 13-15, 1995)
SAFETY-KLEEN CHICAGO RECYCLE CENTER, CHICAGO, IL

SAMPLE I.D.	GP1		GP3		GP4		GP5		GP6		GP7		GP7 (DUP)		GP8		GP9		RINSE BLANK1	RINSE BLANK2	RINSE BLANK3	TRIP BLANK	Class II
SAMPLING DATE	9/13/95		9/13/95		9/14/95		9/14/95		9/14/95		9/14/95		9/14/95		9/14/95		9/15/95		9/13/95	9/14/95	9/15/95	9/11/95	Standard
SAMPLING DEPTH/INTERVAL (ft)	9-11		7-9		2-4		2-4		2-4		11-13		11-13		4-6		9-11		9/13/95	9/14/95	9/15/95	9/11/95	(µg/l)
SEMI-VOLATILE ORGANICS (µg/L)	PQL	Flag	QL	Flag	QL	Flag	PQL	Flag	PQL	Flag	PQL	Flag	PQL	Flag	PQL	Flag	PQL	Flag	PQL	Flag	PQL	Flag	
Phenol			nd 13	UR	nd 10	U	11 10		nd 10	UR	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10.9	U	100
1,2-Dichlorobenzene			nd 13	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	130 10	U	nd 10	U	nd 10.9	U	na
2-Methylnaphthalene			nd 13	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10.9	U	na
Phenanthrene			nd 13	U	nd 10	U	60 10		nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10.9	U	na
Benzo (a) Anthracene			nd 13	U	nd 10	U	23 10		nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10.9	U	na
Chrysene			nd 13	U	nd 10	U	24 10		nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10.9	U	na
bis (2-Ethylhexyl) Phthalate			nd 13	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	21 10		nd 10	U	nd 10	U	nd 10	U	nd 10.9	U	na
Benzyl alcohol			nd 13	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	14 10		13 10		na
Benzoic acid			nd 65	UR	nd 50	U	nd 50	U	nd 50	UR	nd 50	U	nd 50	U	nd 50	U	nd 10	U	nd 10	U	nd 10.9	U	na
2-Methylphenol			nd 13	UR	nd 10	U	nd 10	U	93 20	*J	nd 10	U	nd 10	U	nd 10	U	nd 50	U	nd 50	U	nd 54.5	U	na
4-Methylphenol			nd 13	UR	nd 10	U	nd 10	U	130 20	*J	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10.9	U	na
Isophorone			nd 13	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10.9	U	na
2,4-Dimethylphenol			nd 13	UR	nd 10	U	nd 10	U	nd 10	UR	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10.9	U	na
Naphthalene			nd 13	U	nd 10	U	54 10		nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10.9	U	na
4-Chloro-3-Methylphenol			nd 13	UR	nd 10	U	nd 10	U	nd 10	UR	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10.9	U	na
2,6-Dinitrotoluene			nd 13	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10.9	U	na
Acenaphthene			nd 13	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10.9	U	na
Dibenzofuran			nd 13	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10.9	U	na
Fluorene			nd 13	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10.9	U	na
Pyridine			nd 5	U	160 10		nd 10	U	52 20	*	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10.9	U	na
3-Picoline			4400 1000		8600 500	E*	nd 10	U	11000 500	E*	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 5	U	nd 10.9	U	na
1-Methyl-2-pyrrolidinone			170 65	*	470 10	E*	nd 10	U	5200 20	E*	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10.9	U	na
N,N-Dimethylacetamide			29 13		130 10		nd 10	U	470 20	E*	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10.9	U	na
Acetophenone			nd 13	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10.9	U	na
2-Chlorophenol			nd 13	UR	nd 10	U	nd 10	U	nd 10	UR	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10.9	U	na
2-Nitrophenol			nd 13	UR	nd 10	U	nd 10	U	nd 10	UR	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10.9	U	na
2,4-Dichlorophenol			nd 13	UR	nd 10	U	nd 10	U	nd 10	UR	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10.9	U	na
2,4,6-Trichlorophenol			nd 13	UR	nd 10	U	nd 10	U	nd 10	UR	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10	U	nd 10.9	U	na
2,4,5-Trichlorophenol			nd 65	UR	nd 50	U	nd 50	U	nd 50	UR	nd 50	U	nd 50	U	nd 50	U	nd 50	U	nd 50	U	nd 54.5	U	na
2,4-Dinitrophenol			nd 65	UR	nd 50	U	nd 50	U	nd 50	UR	nd 50	U	nd 50	U	nd 50	U	nd 50	U	nd 50	U	nd 54.5	U	na
4-Nitrophenol			nd 65	UR	nd 50	U	nd 50	U	nd 50	UR	nd 50	U	nd 50	U	nd 50	U	nd 50	U	nd 50	U	nd 54.5	U	na
4,6-Dinitro-2-Methylphenol			nd 65	UR	nd 50	U	nd 50	U	nd 50	UR	nd 50	U	nd 50	U	nd 50	U	nd 50	U	nd 50	U	nd 54.5	U	na
Pentachlorophenol			nd 65	UR	nd 50	U	nd 50	U	nd 50	UR	nd 50	U	nd 50	U	nd 50	U	nd 50	U	nd 50	U	nd 54.5	U	na
Lab Name	IEA		IEA		IEA		IEA		IEA		IEA		IEA		IEA		IEA		IEA		IEA		na
Analytical Method	SW-846		SW-846		SW-846		SW-846		SW-846		SW-846		SW-846		SW-846		SW-846		SW-846		SW-846		
Source Document(s)	8240 & 8270		8240 & 8270		8240 & 8270		8240 & 8270		8240 & 8270		8240 & 8270		8240 & 8270		8240 & 8270		8240 & 8270		8240 & 8270		8240 & 8270		
	1		1		1		1		1		1		1		1		1		1		1		

1 Loose Lab Sheet provided by IEA, Schaumburg, IL October 3, 1995

PQL Practical Quantitation Limit

QL Quantitation Limit which equals to PQL multiplies by the Dilution Factor

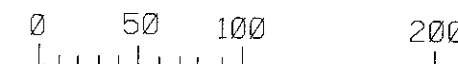
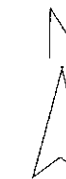
Flag data qualifier

U Compound was not detected at or above the reporting limit

E Sample result exceeds the detection level

E* Sample was diluted due to exceeding the detection level, the concentration used here is the highest among each run

* Concentration used here is the value after dilution although no "E" which represents exceeding the PQL was labelled.




Legend

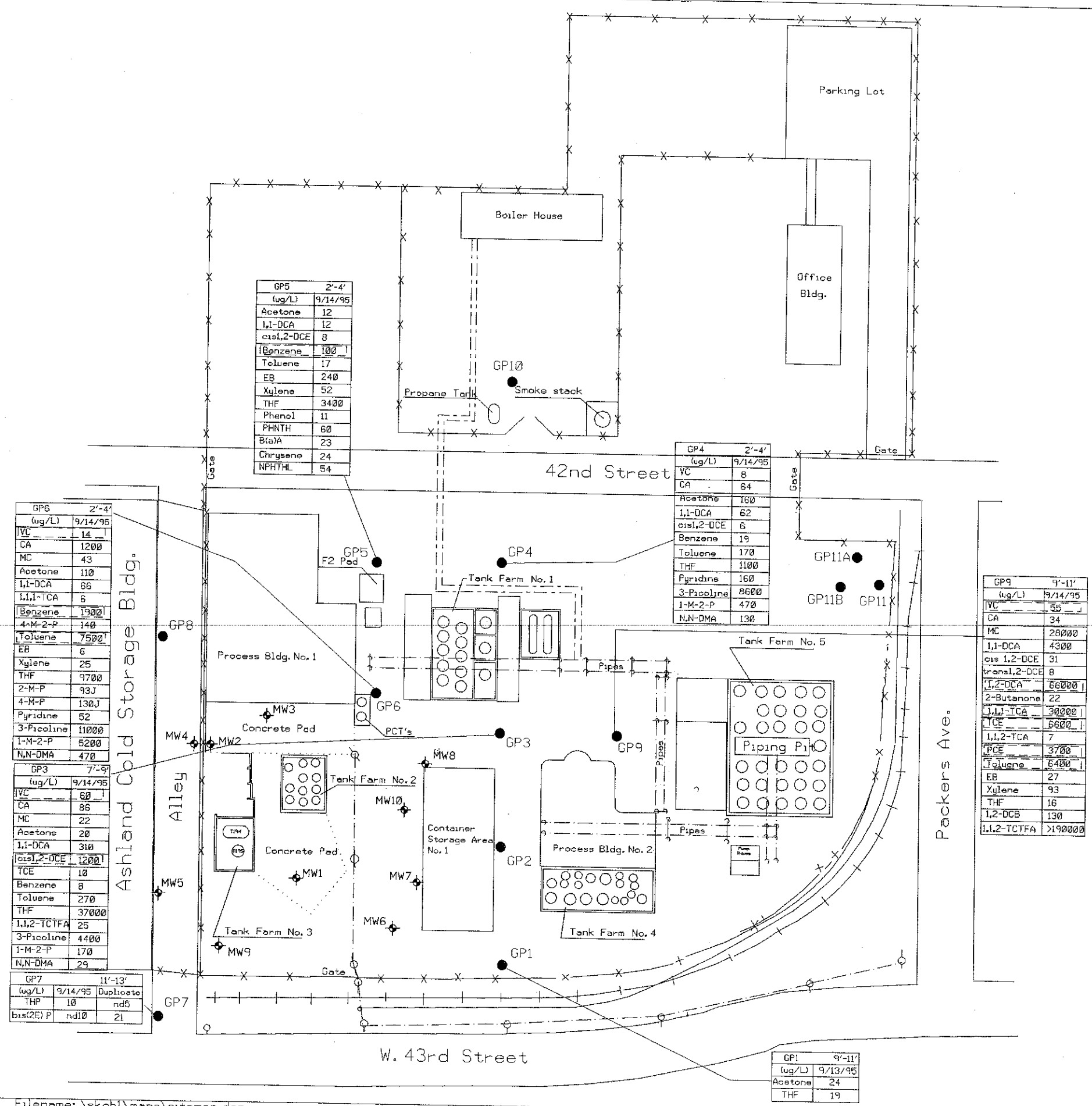
- Building or Street Outline
- Concrete Pad
- Overhead Line or Pipe
- Fenceline
- MW8 Monitoring Well
- GP4 Geoprobe Sampling Location
- Concentration exceeds Class II Standard (ug/L)

Chemicals	Class II Standards
VC: Vinyl Chloride	10
CA: Chloroethane	
MC: Methylene Chloride	
Acetone	
1,1-DCA: 1,1-Dichloroethane	
cis 1,2-DCE: cis 1,2-Dichloroethane	200
trans 1,2-DCE: trans 1,2-Dichloroethane	500
1,2-DCA: 1,2-Dichloroethane	25
1,1,1-TCA: 1,1,1-Trichloroethane	1000
TCE: Trichloroethane	25
1,1,2-TCA: 1,1,2-Trichloroethane	
Benzene	25
PCE: Tetrachloroethane	25
Toluene	2500
EB: Ethylbenzene	1000
Xylenes	10000
THF: Tetrahydrofuran	
1,1,2-TCTFA: 1,1,2-Trichlorotrifluoroethane	
1,2-DCB: 1,2-Dichlorobenzene	
PHNTH: Phenanthrene	
bis (2E) P: bis (2-Ethylhexyl) Phthalate	
B (a) A: Benzo (a) Anthracene	
2-M-P: 2-Methylphenol	
4-M-P: 4-Methylphenol	
NPHTHL: Naphthalene	
Pyridine	
1-M-2-P: 1-Methyl-2-Pyrrolidinone	
4-M-2-P: 4-Methyl-2-Pentanone	
N,N-DMA: N,N-Dimethylacetamide	

SAFETY-KLEEN CORP.
Chicago Recycle Center

Compounds Detected in Groundwater September 1995

 LTI-Environmental Engineering
501 Avis Drive, Ann Arbor, MI 48108



Attachment D.

IEA Summary Reports for September, 1995 Soil Analytical Data



IEA
An Aquarion Company

Client: Limno-Tech
IEA Job#: CH951545
Project #: SKCH3
Matrix: Soil
Method: 8240

EPA Target Compound List (TCL)
Volatile Organic Compounds
(µg/Kg) - Dry Weight

Analyte	Lab ID	Dilution Factor (DF)					POL
		1	1	1	1	1	
		Method Blank	Client ID				
		VO091995	VO092095	VO092295	VO091995	VO092295	
		GP1-2'-3'	GP1-2'-3' RE	GP1-14'-16'	GP2-2'-4'	Dupa Soil	
	951545014	951545014	RE	951545015	951545016	951545017	
Chloromethane	U	U	U	U	U	U	10
Bromomethane	U	U	U	U	U	U	10
Vinyl Chloride	U	U	U	U	14	440 E	2
Chloroethane	U	U	U	U	U	61	10
Methylene Chloride	17	44	34	38	470 E		5
Acetone	U	U	14	U	U	U	10
Carbon Disulfide	U	U	U	U	U	23	5
1,1-Dichloroethene	U	U	U	U	U	28	5
1,1-Dichloroethane	38	71	U	56	1100 E		5
cis-1,2-Dichloroethene	21	40	U	120	2200 E		5
trans-1,2-Dichloroethene	U	U	U	U	60		5
Chloroform	U	U	U	U	7		5
1,2-Dichloroethane	U	U	U	U	6		5
2-Butanone	U	U	U	U	U		10
1,1,1-Trichloroethane	84	160	U	24	860 E		5
Carbon Tetrachloride	U	U	U	U	U		5
Vinyl Acetate	U	U	U	U	U		10
Bromodichloromethane	U	U	U	U	U		5
1,2-Dichloropropane	U	U	U	U	U		5
Trans-1,3-dichloropropene	U	U	U	U	U		5
Trichloroethylene	88	190	U	24	680 E		5
Dibromochloromethane	U	U	U	U	U		5
1,1,2-Trichloroethane	U	U	U	U	9		5
Benzene	U	U	U	U	40		5
cis-1,3-Dichloropropene	U	U	U	U	U		5
2-Chloroethylvinylether	U	U	U	U	U		5
Bromoform	U	U	U	U	U		5
4-Methyl-2-Pentanone	U	U	U	U	U		10
2-Hexanone	U	U	U	U	U		10
Tetrachloroethylene	110	260	U	58	2000 E		5
1,1,2,2-Tetrachloroethane	U	U	U	U	U		5
Toluene	U	10	U	U	14		5
Chlorobenzene	U	U	U	U	U		5
Ethylbenzene	U	U	U	U	U		5
Styrene	U	U	U	U	U		5
Total Xylenes	U	6	U	U	7		5
Date Sampled	9/13/95	9/13/95	9/13/95	9/13/95	9/13/95	9/13/95	
Date Analyzed	9/19/95	9/20/95	9/22/95	9/19/95	9/22/95		

POL = Practical Quantitation Limit

To obtain sample-specific quantitation limit, multiply the POL by the Dilution Factor.



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IEA

An Aquation Company

Client: Limno-Tech

IEA Job#: CH951545

Project #: SKCH3

Matrix: Soil

Method: 8240

EPA Target Compound List (TCL) Volatile Organic Compounds (µg/Kg) - Dry Weight

Analyte	Lab ID	Dilution Factor (DF)		Method Blank	Client ID	Dupa Soil DL	GP2-15'-17'	GP3-2'-4'	GP3-14'-16'	GP3-14'-16' RE	POL
		50	1	1	1	1	1	1	1	1	
Chloromethane	UD	UD	U	U	U	U	U	U	U	U	10
Bromomethane	UD	UD	U	U	U	U	U	U	U	U	10
Vinyl Chloride	240	U	U	U	U	U	U	U	U	U	2
Chloroethane	UD	U	U	U	U	U	U	U	U	U	10
Methylene Chloride	690	U	U	56	U	59	U	U	U	U	5
Acetone	UD	UD	29	52	19	23	U	U	U	U	10
Carbon Disulfide	UD	U	U	U	U	U	U	U	U	U	5
1,1-Dichloroethene	UD	U	U	U	U	U	U	U	U	U	5
1,1-Dichloroethane	2100	U	U	U	U	U	U	U	U	U	5
cis-1,2-Dichloroethene	2100	U	U	U	U	U	U	U	U	U	5
trans-1,2-Dichloroethene	UD	U	U	U	U	U	U	U	U	U	5
Chloroform	UD	U	U	U	U	U	U	U	U	U	5
1,2-Dichloroethane	UD	U	U	U	U	U	U	U	U	U	5
2-Butanone	UD	U	U	14	U	U	U	U	U	U	10
1,1,1-Trichloroethane	2400	U	U	U	U	U	U	U	U	U	5
Carbon Tetrachloride	UD	U	U	U	U	U	U	U	U	U	5
Vinyl Acetate	UD	U	U	U	U	U	U	U	U	U	10
Bromodichloromethane	UD	U	U	U	U	U	U	U	U	U	5
1,2-Dichloropropane	UD	U	U	U	U	U	U	U	U	U	5
Trans-1,3-dichloropropene	UD	U	U	U	U	U	U	U	U	U	5
Trichloroethylene	2200	U	U	U	U	U	U	U	U	U	5
Dibromochloromethane	UD	U	U	U	U	U	U	U	U	U	5
1,1,2-Trichloroethane	UD	U	U	U	U	U	U	U	U	U	5
Benzene	UD	U	U	20	U	U	U	U	U	U	5
cis-1,3-Dichloropropene	UD	U	U	U	U	U	U	U	U	U	5
2-Chloroethylvinylether	UD	U	U	U	U	U	U	U	U	U	5
Bromoform	UD	U	U	U	U	U	U	U	U	U	5
4-Methyl-2-Pentanone	UD	U	U	U	U	U	U	U	U	U	10
2-Hexanone	UD	U	U	U	U	U	U	U	U	U	10
Tetrachloroethylene	5600	U	U	U	U	U	U	U	U	U	5
1,1,2,2-Tetrachloroethane	UD	U	U	240	U	U	U	U	U	U	5
Toluene	UD	U	U	U	U	U	U	U	U	U	5
Chlorobenzene	UD	U	U	U	U	U	U	U	U	U	5
Ethylbenzene	UD	U	U	27	U	U	U	U	U	U	5
Styrene	UD	U	U	U	U	U	U	U	U	U	5
Total Xylenes	UD	U	U	55	U	U	U	U	U	U	5
Date Sampled	9/13/95	9/13/95	9/13/95	9/13/95	9/13/95	9/13/95	9/13/95	9/13/95	9/13/95	9/13/95	
Date Analyzed	9/27/95	9/19/95	9/19/95	9/19/95	9/19/95	9/19/95	9/19/95	9/19/95	9/19/95	9/20/95	

PQL = Practical Quantitation Limit

To obtain sample-specific quantitation limit, multiply the PQL by the Dilution Factor.



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IEA

An Aquation Company

Client: Limno-Tech

IEA Job#: CH951545

Project #: SKCH3

Matrix: Soil

Method: 8240

EPA Target Compound List (TCL)
Volatile Organic Compounds
(µg/Kg) - Dry Weight

Dilution Factor (DF)	1	1	50	1	5	POL
	Method Blank	Method Blank	Method Blank	Method Blank	Method Blank	
Analyte	Client ID	Client ID	Client ID	Client ID	Client ID	POL
	Lab ID	Lab ID	Lab ID	Lab ID	Lab ID	
Chloromethane	U	U	U	U	UD	10
Bromomethane	U	U	U	U	UD	10
Vinyl Chloride	U	U	U	U	UD	2
Chloroethane	U	U	U	260	130	10
Methylene Chloride	21	9	U	97	56	5
Acetone	46	29	U	130	37 J	10
Carbon Disulfide	U	U	U	U	UD	5
1,1-Dichloroethene	U	U	U	U	UD	5
1,1-Dichloroethane	U	U	U	11	UD	5
cis-1,2-Dichloroethene	U	U	U	U	UD	5
trans-1,2-Dichloroethene	U	U	U	U	UD	5
Chloroform	U	U	U	U	UD	5
1,2-Dichloroethane	U	U	U	U	UD	5
2-Butanone	U	U	U	30	UD	10
1,1,1-Trichloroethane	U	U	U	U	UD	5
Carbon Tetrachloride	U	U	U	U	UD	5
Vinyl Acetate	U	U	U	U	UD	10
Bromodichloromethane	U	U	U	U	UD	5
1,2-Dichloropropane	U	U	U	U	UD	5
Trans-1,3-dichloropropene	U	U	U	U	UD	5
Trichloroethylene	U	U	U	U	UD	5
Dibromochloromethane	U	U	U	U	UD	5
1,1,2-Trichloroethane	U	U	U	U	UD	5
Benzene	U	56	U	220	250	5
cis-1,3-Dichloropropene	U	U	U	U	UD	5
2-Chloroethylvinylether	U	U	U	U	UD	5
Bromoform	U	U	U	U	UD	5
4-Methyl-2-Pentanone	U	U	U	U	UD	10
2-Hexanone	U	U	U	U	UD	10
Tetrachloroethylene	U	U	U	U	UD	5
1,1,2,2-Tetrachloroethane	U	U	U	U	UD	5
Toluene	34	U	U	2400 E	440	5
Chlorobenzene	U	U	U	U	UD	5
Ethylbenzene	U	3100 E	7300	8	UD	5
Styrene	U	U	U	U	UD	5
Total Xylenes	U	4600 E	12000	12	UD	5
Date Sampled	9/14/95	9/14/95	9/14/95	9/14/95	9/14/95	
Date Analyzed	9/19/95	9/19/95	9/20/95	10/1/95	9/20/95	

POL = Practical Quantitation Limit

To obtain sample-specific quantitation limit, multiply the POL by the Dilution Factor.



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IEA

An Aquarion Company

Client: Limno-Tech

IEA Job#: CH951545

Project #: SKCH3

Matrix: Soil

Method: 8240

EPA Target Compound List (TCL)
Volatile Organic Compounds
(µg/Kg) - Dry Weight

Dilution Factor (DF)	1	1	1	1	1	PQL
Method Blank	VO092095	VO092295	VO092095	VO092295	VO092095	
Client ID	GP6-13-15'	GP6-13-15'	GP7-2-4'	GP7-2-4'	GP7-13-15'	
	951545024	RE	951545025	RE	951545026	
Analyte	Lab ID	951545024	RE	951545025	RE	951545026
Chloromethane	U	U	U	U	U	10
Bromomethane	U	U	U	U	U	10
Vinyl Chloride	U	U	U	U	U	2
Chloroethane	U	U	U	U	U	10
Methylene Chloride	36	U	40	45	32	5
Acetone	34	21	U	U	14	10
Carbon Disulfide	U	U	U	U	U	5
1,1-Dichloroethene	U	U	U	U	U	5
1,1-Dichloroethane	U	U	U	U	U	5
cis-1,2-Dichloroethene	U	U	U	U	U	5
trans-1,2-Dichloroethene	U	U	U	U	U	5
Chloroform	U	U	U	U	U	5
1,2-Dichloroethane	U	U	U	U	U	5
2-Butanone	U	U	U	U	U	10
1,1, 1-Trichloroethane	U	U	U	U	U	5
Carbon Tetrachloride	U	U	U	U	U	5
Vinyl Acetate	U	U	U	U	U	10
Bromodichloromethane	U	U	U	U	U	5
1,2-Dichloropropane	U	U	U	U	U	5
Trans-1,3-dichloropropene	U	U	U	U	U	5
Trichloroethylene	U	U	U	U	U	5
Dibromochloromethane	U	U	U	U	U	5
1,1,2-Trichloroethane	U	U	U	U	U	5
Benzene	U	U	U	U	U	5
cis-1,3-Dichloropropene	U	U	U	U	U	5
2-Chloroethylvinylether	U	U	U	U	U	5
Bromoform	U	U	U	U	U	5
4-Methyl-2-Pentanone	U	U	U	U	U	10
2-Hexanone	U	U	U	U	U	10
Tetrachloroethylene	U	U	U	U	U	5
1,1,2,2-Tetrachloroethane	U	U	U	U	U	5
Toluene	U	U	U	U	U	5
Chlorobenzene	U	U	U	U	U	5
Ethylbenzene	U	U	U	U	U	5
Styrene	U	U	U	U	U	5
Total Xylenes	U	U	U	U	U	5
Date Sampled	9/14/95	9/14/95	9/14/95	9/14/95	9/14/95	
Date Analyzed	9/20/95	9/22/95	9/20/95	9/22/95	9/20/95	

PQL = Practical Quantitation Limit

To obtain sample-specific quantitation limit, multiply the PQL by the Dilution Factor.



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IEA
An Aquarion Company

Client: Limno-Tech
IEA Job#: CH951545
Project #: SKCH3
Matrix: Soil
Method: 8240

EPA Target Compound List (TCL)
Volatile Organic Compounds
(µg/Kg) - Dry Weight

Analyte	Lab ID	Dilution Factor (DF)					PQL
		1	1	1	1	1	
		Method Blank	Client ID	GP7-13-15'	GP8-2'-4'	GP8-13'-15'	
		VO092295	GP7-13-15'	VO092295	GP8-2'-4'	VO092295	GP8-13'-15'
		RE	RE	RE	RE	RE	RE
		951545026	951545027	951545027	951545028	951545028	RE
Chloromethane	U	U	U	U	U	U	10
Bromomethane	U	U	U	U	U	U	10
Vinyl Chloride	U	U	U	U	U	U	2
Chloroethane	U	U	U	U	U	U	10
Methylene Chloride	11	51	120	19	26		5
Acetone	21	U	U	U	U	U	10
Carbon Disulfide	U	U	U	U	U	U	5
1,1-Dichloroethene	U	U	U	U	U	U	5
1,1-Dichloroethane	U	U	U	U	U	U	5
cis-1,2-Dichloroethene	U	U	U	U	U	U	5
trans-1,2-Dichloroethene	U	U	U	U	U	U	5
Chloroform	U	U	U	U	U	U	5
1,2-Dichloroethane	U	U	U	U	U	U	5
2-Butanone	U	U	U	U	U	U	10
1,1,1-Trichloroethane	U	U	U	U	U	U	5
Carbon Tetrachloride	U	U	U	U	U	U	5
Vinyl Acetate	U	U	U	U	U	U	10
Bromodichloromethane	U	U	U	U	U	U	5
1,2-Dichloropropane	U	U	U	U	U	U	5
Trans-1,3-dichloropropene	U	U	U	U	U	U	5
Trichloroethylene	U	U	U	U	U	U	5
Dibromochloromethane	U	U	U	U	U	U	5
1,1,2-Trichloroethane	U	U	U	U	U	U	5
Benzene	U	U	U	U	U	U	5
cis-1,3-Dichloropropene	U	U	U	U	U	U	5
2-Chloroethylvinylether	U	U	U	U	U	U	5
Bromoform	U	U	U	U	U	U	5
4-Methyl-2-Pentanone	U	U	U	U	U	U	10
2-Hexanone	U	U	U	U	U	U	10
Tetrachloroethylene	U	U	U	U	U	U	5
1,1,2,2-Tetrachloroethane	U	U	U	U	U	U	5
Toluene	U	U	U	U	U	U	5
Chlorobenzene	U	U	U	U	U	U	5
Ethylbenzene	U	U	U	U	U	U	5
Styrene	U	U	U	U	U	U	5
Total Xylenes	U	U	U	U	U	U	5
Date Sampled	9/14/95	9/14/95	9/14/95	9/14/95	9/14/95	9/14/95	
Date Analyzed	9/22/95	9/20/95	9/22/95	9/21/95	9/22/95		

PQL = Practical Quantitation Limit
To obtain sample-specific quantitation limit, multiply the PQL by the Dilution Factor.



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IEA

An Aquation Company

Client: Limno-Tech

IEA Job#: CH951545

Project #: SKCH3

Matrix: Soil

Method: 8240

EPA Target Compound List (TCL) Volatile Organic Compounds (µg/Kg) - Dry Weight

Analyte	Dilution Factor (DF)		Method Blank		Client ID		PQL
	1	1	1	1	1	1	
	Lab ID	Lab ID	Lab ID	Lab ID	Lab ID	Lab ID	
Chloromethane	U	U	U	U	U	U	10
Bromomethane	U	U	U	U	U	U	10
Vinyl Chloride	U	U	U	U	U	U	2
Chloroethane	U	U	U	U	U	U	10
Methylene Chloride	51	13	U	21	21	U	5
Acetone	130	20	U	U	U	U	10
Carbon Disulfide	U	U	U	U	U	U	5
1,1-Dichloroethene	U	U	U	U	U	U	5
1,1-Dichloroethane	U	U	U	U	U	U	5
cis-1,2-Dichloroethene	U	U	U	U	U	U	5
trans-1,2-Dichloroethene	U	U	U	U	U	U	5
Chloroform	U	U	U	U	U	U	5
1,2-Dichloroethane	U	U	U	U	U	U	5
2-Butanone	21	U	U	U	U	21	10
1,1,1-Trichloroethane	U	U	U	U	U	U	5
Carbon Tetrachloride	U	U	U	U	U	U	5
Vinyl Acetate	U	U	U	U	U	U	10
Bromodichloromethane	U	U	U	U	U	U	5
1,2-Dichloropropane	U	U	U	U	U	U	5
Trans-1,3-dichloropropene	U	U	U	U	U	U	5
Trichloroethylene	U	U	U	U	U	U	5
Dibromochloromethane	U	U	U	U	U	U	5
1,1,2-Trichloroethane	U	U	U	U	U	U	5
Benzene	U	U	U	U	U	U	5
cis-1,3-Dichloropropene	U	U	U	U	U	U	5
2-Chloroethylvinylether	U	U	U	U	U	U	5
Bromoform	U	U	U	U	U	U	5
4-Methyl-2-Pentanone	U	U	U	U	U	U	10
2-Hexanone	U	U	U	U	U	U	10
Tetrachloroethylene	U	U	U	U	U	U	5
1,1,2,2-Tetrachloroethane	U	U	U	U	U	U	5
Toluene	U	U	U	U	U	U	5
Chlorobenzene	U	U	U	U	U	U	5
Ethylbenzene	U	U	U	U	U	U	5
Styrene	U	U	U	U	U	U	5
Total Xylenes	U	U	U	U	U	U	5
Date Sampled	9/15/95	9/15/95	9/15/95	9/15/95	9/15/95	9/15/95	
Date Analyzed	9/21/95	9/21/95	9/22/95	9/19/95	9/21/95	9/21/95	

PQL = Practical Quantitation Limit

To obtain sample-specific quantitation limit, multiply the PQL by the Dilution Factor.



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IEA
An Aquarion Company

Client: Limno-Tech
IEA Job#: CH951545
Project #: SKCH3
Matrix: Soil
Method: 8240

EPA Target Compound List (TCL)
Volatile Organic Compounds
(µg/Kg) - Dry Weight

Analyte	Lab ID	Dilution Factor (DF)					PQL
		1	1	1	1	1	
		Method Blank	Method Blank	Method Blank	Method Blank	Method Blank	
		VO092195	VO091995	VO092095	VO092195	VO092295	
		Client ID	DUPF-SOIL				
		951545033					
Chloromethane		U	U	U	U	U	10
Bromomethane		U	U	U	U	U	10
Vinyl Chloride		U	U	U	U	U	2
Chloroethane		U	U	U	U	U	10
Methylene Chloride	240	U	U	U	U	U	5
Acetone	U	U	U	U	U	U	10
Carbon Disulfide	U	U	U	U	U	U	5
1,1-Dichloroethene	U	U	U	U	U	U	5
1,1-Dichloroethane	U	U	U	U	U	U	5
cis-1,2-Dichloroethene	U	U	U	U	U	U	5
trans-1,2-Dichloroethene	U	U	U	U	U	U	5
Chloroform	U	U	U	U	U	U	5
1,2-Dichloroethane	U	U	U	U	U	U	5
2-Butanone	U	U	U	U	U	U	10
1,1, 1-Trichloroethane	U	U	U	U	U	U	5
Carbon Tetrachloride	U	U	U	U	U	U	5
Vinyl Acetate	U	U	U	U	U	U	10
Bromodichloromethane	U	U	U	U	U	U	5
1,2-Dichloropropane	U	U	U	U	U	U	5
Trans-1,3-dichloropropene	U	U	U	U	U	U	5
Trichloroethylene	U	U	U	U	U	U	5
Dibromochloromethane	U	U	U	U	U	U	5
1,1,2-Trichloroethane	U	U	U	U	U	U	5
Benzene	U	U	U	U	U	U	5
cis-1,3-Dichloropropene	U	U	U	U	U	U	5
2-Chloroethylvinylether	U	U	U	U	U	U	5
Bromoform	U	U	U	U	U	U	5
4-Methyl-2-Pentanone	U	U	U	U	U	U	10
2-Hexanone	U	U	U	U	U	U	10
Tetrachloroethylene	U	U	U	U	U	U	5
1,1,2,2-Tetrachloroethane	U	U	U	U	U	U	5
Toluene	U	U	U	U	U	U	5
Chlorobenzene	U	U	U	U	U	U	5
Ethylbenzene	U	U	U	U	U	U	5
Styrene	U	U	U	U	U	U	5
Total Xylenes	U	U	U	U	U	U	5
Date Sampled	9/14/95	---	---	---	---	---	
Date Analyzed	9/21/95	9/19/95	9/20/95	9/21/95	9/22/95		

PQL = Practical Quantitation Limit
To obtain sample-specific quantitation limit, multiply the PQL by the Dilution Factor.



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IEA

An Aquarion Company

Client: Limno-Tech

IEA Job#: CH951545

Project #: SKCH3

Matrix: Soil

Method: 8240

EPA Target Compound List (TCL)

Volatile Organic Compounds

(µg/Kg) - Dry Weight

Analyte	Lab ID	Dilution Factor (DF)							PQL
		1	1						
		Method Blank	Method Blank						
Chloromethane		U	U						10
Bromomethane		U	U						10
Vinyl Chloride		U	U						2
Chloroethane		U	U						10
Methylene Chloride		U	U						5
Acetone		U	U						10
Carbon Disulfide		U	U						5
1,1-Dichloroethene		U	U						5
1,1-Dichloroethane		U	U						5
cis-1,2-Dichloroethene		U	U						5
trans-1,2-Dichloroethene		U	U						5
Chloroform		U	U						5
1,2-Dichloroethane		U	U						5
2-Butanone		U	U						10
1,1,1-Trichloroethane		U	U						5
Carbon Tetrachloride		U	U						5
Vinyl Acetate		U	U						10
Bromodichloromethane		U	U						5
1,2-Dichloropropane		U	U						5
Trans-1,3-dichloropropene		U	U						5
Trichloroethylene		U	U						5
Dibromochloromethane		U	U						5
1,1,2-Trichloroethane		U	U						5
Benzene		U	U						5
cis-1,3-Dichloropropene		U	U						5
2-Chloroethylvinylether		U	U						5
Bromoform		U	U						5
4-Methyl-2-Pentanone		U	U						10
2-Hexanone		U	U						10
Tetrachloroethylene		U	U						5
1,1,2,2-Tetrachloroethane		U	U						5
Toluene		U	U						5
Chlorobenzene		U	U						5
Ethylbenzene		U	U						5
Styrene		U	U						5
Total Xylenes		U	U						5
Date Sampled	---	---	---						
Date Analyzed	9/27/95	10/1/95							

PQL = Practical Quantitation Limit

To obtain sample-specific quantitation limit, multiply the PQL by the Dilution Factor.



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IEA
An Aquarion Company

CLIENT: Limno-Tech
IEA PROJECT #: CH951545
CLIENT PROJECT ID: SKCH3
MATRIX: Soil

POLYNUCLEAR AROMATIC
HYDROCARBONS (PNA)
SW-846 METHOD 8310

(ug/kg) dry weight

CLIENT ID	GP1 (2-3)	GP1 (14-16)	GP2 (2-4)	DUPA Soil	GP2 (15-17)	
LAB ID	951545 014	951545 015	951545 016	951545 017	951545 018	PQL

COMPOUNDS

Napthalene	16000	U	2000	1300	U	660
Acenaphthylene	UD	U	U	U	U	660
Acenaphthene	UD	U	U	U	U	1200
Fluorene	UD	U	200	160	U	140
Phenanthrene	UD	U	2400	1500	U	660
Anthracene	UD	U	770	U	U	660
Fluoranthene	30000	U	2700	2400	U	660
Pyrene	34000	U	2900	2300	U	180
Benzo(a)anthracene	13000	27	1400	970	32	8.7
Chrysene	13000	U	1500	1300	U	100
Benzo(b)fluoranthene	9300	U	1200	950	16	11
Benzo(k)fluoranthene	5900	U	670	590	12	11
Benzo(a)pyrene	12000	19	1700	1300	U	15
Indeno(1,2,3-cd)pyrene	7400	U	1100	960	U	29
Dibenzo(a,h)anthracene	UD	U	U	U	U	20
Benzo(g,h,i)perylene	8300	U	1400	1300	U	51
DATE SAMPLED	09/13/95	09/13/95	09/13/95	09/13/95	09/13/95	
DATE EXTRACTED	09/26/95	09/26/95	09/26/95	09/26/95	09/26/95	
DATE ANALYZED	09/27/95	09/27/95	09/27/95	09/30/95	09/28/95	
DILUTION FACTOR	20	1	1	1	1	



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IEA

An Aquation Company

CLIENT: Limno-Tech

IEA PROJECT #: CH951545

CLIENT PROJECT ID: SKCH3

MATRIX: Soil

POLYNUCLEAR AROMATIC
HYDROCARBONS (PNA)
SW-846 METHOD 8310

(ug/kg) dry weight

CLIENT ID	GP3	GP3	GP4	GP5	GP6	POL
	(2-4) 951545 019	(14-16) 951545 020	(2-4) soil 951545 021	(2-4) soil 951545 022	(2-4) soil 951545 023	

COMPOUNDS

Naphthalene	U	U	860	1300	U	660
Acenaphthylene	U	U	U	U	U	660
Acenaphthene	U	U	U	U	U	1200
Fluorene	U	U	U	U	U	140
Phenanthrene	U	U	U	U	U	660
Anthracene	U	U	U	U	U	660
Fluoranthene	U	U	U	U	U	660
Pyrene	U	U	370	560	U	180
Benzo(a)anthracene	U	26	180	250	21	8.7
Chrysene	U	U	120	U	U	100
Benzo(b)fluoranthene	U	64	110	190	25	11
Benzo(k)fluoranthene	U	27	63	110	15	11
Benzo(a)pyrene	U	U	160	360	50	15
Indeno(1,2,3-cd)pyrene	U	U	86	200	45	29
Dibenzo(a,h)anthracene	U	U	U	U	U	20
Benzo(g,h,i)perylene	U	U	85	470	U	51
DATE SAMPLED	09/13/95	09/13/95	09/14/95	09/14/95	09/14/95	
DATE EXTRACTED	09/26/95	09/26/95	09/26/95	09/26/95	09/26/95	
DATE ANALYZED	09/28/95	09/28/95	09/28/95	09/28/95	09/28/95	
DILUTION FACTOR	1	1	1	1	1	



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IEA

An Aquarion Company

CLIENT: Limno-Tech

IEA PROJECT #: CH951545

CLIENT PROJECT ID: SKCH3

MATRIX: Soil

POLYNUCLEAR AROMATIC
HYDROCARBONS (PNA)
SW-846 METHOD 8310

(ug/kg) dry weight

CLIENT ID	GP6	GP7	GP7	GP8	GP8	POL
	(13-15)	(2-4)	(13-15)	(2-4)	(2-4)	
LAB ID	951545	951545	951545	951545	951545	
	024	025	026	027	027 DL	

COMPOUNDS

Naphthalene	U	2600	U	8500E	UD	660
Acenaphthylene	U	U	U	3400	UD	660
Acenaphthene	U	U	U	U	UD	1200
Fluorene	U	U	U	1700	UD	140
Phenanthrene	U	1700	U	5300E	UD	660
Anthracene	U	U	U	3700	UD	660
Fluoranthene	U	1700	U	1800E	UD	660
Pyrene	U	670	U	1500E	14000	180
Benzo(a)anthracene	32	730	U	5200E	5400	8.7
Chrysene	U	510	U	3600	6100	100
Benzo(b)fluoranthene	U	330	U	3400	3600	11
Benzo(k)fluoranthene	U	230	U	2300	2200	11
Benzo(a)pyrene	18	970	U	6100E	6000	15
Indeno(1,2,3-cd)pyrene	U	450	U	3600	3600	29
Dibenzo(a,h)anthracene	U	U	U	U	UD	20
Benzo(g,h,i)perylene	U	660	U	4300E	4300	51
DATE SAMPLED	09/14/95	09/14/95	09/14/95	09/14/95	09/14/95	
DATE EXTRACTED	09/26/95	09/26/95	09/26/95	09/26/95	09/26/95	
DATE ANALYZED	09/28/95	09/30/95	09/28/95	09/30/95	09/28/95	
DILUTION FACTOR	1	1	1	1	20	



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IEA

An Aquation Company

CLIENT: Limno-Tech
IEA PROJECT #: CH951545
CLIENT PROJECT ID: SKCH3
MATRIX: Soil

POLYNUCLEAR AROMATIC
HYDROCARBONS (PNA)
SW-846 METHOD 8310

(ug/kg) dry weight

CLIENT ID	GP8 (13-15)	GP9 (2-4)	GP9 (2-4)	GP9 (14-16)	GP10 (12-14)	
LAB ID	951545	951545	951545	951545	951545	POL
	028	029	029 DL	030	031	

COMPOUNDS

Naphthalene	U	5100E	UD	U	U	660
Acenaphthylene	U	U	UD	U	U	660
Acenaphthene	U	5100E	UD	U	U	1200
Fluorene	U	240	UD	U	U	140
Phenanthrene	U	3800E	UD	U	U	660
Anthracene	U	1200	UD	U	U	660
Fluoranthene	U	5800E	UD	U	U	660
Pyrene	U	5300E	5100	U	U	180
Benzo(a)anthracene	U	2500	2400	U	31	8.7
Chrysene	U	2500	3000	U	U	100
Benzo(b)fluoranthene	U	1900	2100	U	59	11
Benzo(k)fluoranthene	U	1300	1300	U	14	11
Benzo(a)pyrene	U	2900	2600	U	21	15
Indeno(1,2,3-cd)pyrene	U	1800	1700	U	U	29
Dibenzo(a,h)anthracene	U	U	UD	U	U	20
Benzo(g,h,i)perylene	U	2000	1900	U	U	51
DATE SAMPLED	09/14/95	09/15/95	09/15/95	09/15/95	09/15/95	
DATE EXTRACTED	09/26/95	09/26/95	09/26/95	09/26/95	09/26/95	
DATE ANALYZED	09/28/95	09/30/95	09/28/95	09/28/95	09/28/95	
DILUTION FACTOR	1	1	20	1	1	



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IEA
An Aquarion Company

CLIENT: Limno-Tech
IEA PROJECT#: CH951545
CLIENT PROJECT ID: SKCH3
MATRIX: Soil

POLYNUCLEAR AROMATIC
HYDROCARBONS (PNA)
SW-846 METHOD 8310

(ug/kg) dry weight

CLIENT ID	GP10 (2-4)	DUPF SOIL	Method Blank			
LAB ID	951545 032	951545 033	SS0926			POL

COMPOUNDS

Naphthalene	U	U	U			660
Acenaphthylene	U	U	U			660
Acenaphthene	U	U	U			1200
Fluorene	U	U	U			140
Phenanthrene	U	U	U			660
Anthracene	U	U	U			660
Fluoranthene	U	U	U			660
Pyrene	U	U	U			180
Benzo(a)anthracene	46	68	U			8.7
Chrysene	U	U	U			100
Benzo(b)fluoranthene	22	32	U			11
Benzo(k)fluoranthene	15	17	U			11
Benzo(a)pyrene	45	73	U			15
Indeno(1,2,3-cd)pyrene	U	43	U			29
Dibenzo(a,h)anthracene	U	U	U			20
Benzo(g,h,i)perylene	U	54	U			51
DATE SAMPLED	09/15/95	09/15/95				
DATE EXTRACTED	09/26/95	09/26/95	09/26/95			
DATE ANALYZED	09/28/95	09/28/95	09/27/95			
DILUTION FACTOR	1	1	1			



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IEA
An Aquarion Company

Client: LIMNO-TECH
IEA Job #: CH951545
Project #: SKCH3

Matrix: SOIL

ANALYTE LIST

mg/kg

	Client ID	GP1-2'-3'	GP1-14'-16'	GP2-2'-4'	DUPA-SOIL	GP2-15'-17'	Date Analyzed	POL
	Lab ID	951545 014	951545 015	951545 016	951545 017	951545 018		

Analyte	Method	9066	0.63	< 0.60	0.66	< 0.56	< 0.59	10/02/95	0.5 mg/kg
Total Phenols									

	Client ID	GP3-2'-4'	GP3-14'-16'	GP4-2'-4'(SOIL)	GP5-2'-4'(SOIL)	GP6-2'-4'(SOIL)	Date Analyzed	POL
	Lab ID	951545 019	951545 020	951545 021	951545 022	951545 023		

Analyte	Method	9066	0.62	4	< 0.60	< 0.62	< 0.63	10/02/95	0.5 mg/kg
Total Phenols									

	Client ID	GP6-13'-15'	GP7-2'-4'	GP7-13'-15'	GP8-2'-4'	GP8-13'-15'	Date Analyzed	POL
	Lab ID	951545 024	951545 025	951545 026	951545 027	951545 028		

Analyte	Method	9066	2.4	0.78	< 0.61	2.3	< 0.60	10/02/95	0.5 mg/kg
Total Phenols									

	Client ID	GP9-2'-4'	GP9-14'-16'	GP10-12'-14'	GP10-2'-4'	DUPP-SOIL	Date Analyzed	POL
	Lab ID	951545 029	951545 030	951545 031	951545 032	951545 033		

Analyte	Method	9066	4.3	< 0.60	< 0.60	< 0.62	18	10/02/95	0.5 mg/kg
Total Phenols									

POL = Practical Quantitation Limit, varies with sample weight and total solids.

Date Total Phenols extracted: 09/28/95



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Attachment E.

IEA Summary Reports for September, 1995 Groundwater Analytical Data



IEA
An Aquarion Company

Client: Linno-Tech
IEA Job#: CH951545
Project #: SKCH3
Matrix: Water
Method: 8240

EPA Target Compound List (TCL)
Volatile Organic Compounds
(µg/L)

Analyte	Lab ID	Dilution Factor (DF)					PQL
		1	1	1	1	1	
Method Blank		VO092695	VO092695	VO092695	VO092695	VO092695	
Client ID		GP1-9'-11'	Rinse Blank 1	Trip Blank	Rinse Blank 2	GP3-7'-9'	
	951545001	951545002	951545003	951545004	951545005		
Chloromethane	U	U	U	U	U	10	
Bromomethane	U	U	U	U	U	10	
Vinyl Chloride	U	U	U	U	U	2	
Chloroethane	U	U	U	U	U	10	
Methylene Chloride	U	U	U	U	U	5	
Acetone	24	U	U	U	U	10	
Carbon Disulfide	U	U	U	U	U	5	
1,1-Dichloroethene	U	U	U	U	U	5	
1,1-Dichloroethane	U	U	U	U	U	5	
cis-1,2-Dichloroethene	U	U	U	U	U	5	
trans-1,2-Dichloroethene	U	U	U	U	U	5	
Chloroform	U	U	U	U	U	5	
1,2-Dichloroethane	U	U	U	U	U	5	
2-Butanone	U	U	U	U	U	10	
1,1,1-Trichloroethane	U	U	U	U	U	5	
Carbon Tetrachloride	U	U	U	U	U	5	
Vinyl Acetate	U	U	U	U	U	10	
Bromodichloromethane	U	U	U	U	U	5	
1,2-Dichloropropane	U	U	U	U	U	5	
Trans-1,3-dichloropropene	U	U	U	U	U	5	
Trichloroethylene	U	U	U	U	U	5	
Dibromochloromethane	U	U	U	U	U	5	
1,1,2-Trichloroethane	U	U	U	U	U	5	
Benzene	U	U	U	U	U	5	
cis-1,3-Dichloropropene	U	U	U	U	U	5	
2-Chloroethylvinylether	U	U	U	U	U	5	
Bromoform	U	U	U	U	U	5	
4-Methyl-2-Pentanone	U	U	U	U	U	10	
2-Hexanone	U	U	U	U	U	10	
Tetrachloroethylene	U	U	U	U	U	5	
1,1,2,2-Tetrachloroethane	U	U	U	U	U	5	
Toluene	U	U	U	U	U	270 E	
Chlorobenzene	U	U	U	U	U	5	
Ethylbenzene	U	U	U	U	U	5	
Styrene	U	U	U	U	U	5	
Total Xylenes	U	U	U	U	U	5	
Tetrahydrofuran	19	U	U	U	U	5	
1,1,2-Trichlorotrifluoroethane	U	U	U	U	U	10	
Date Sampled	9/13/95	9/13/95	9/11/95	9/14/95	9/14/95		
Date Analyzed	9/26/95	9/26/95	9/26/95	9/26/95	9/27/95		

PQL = Practical Quantitation Limit
To obtain sample-specific quantitation limit, multiply the PQL by the Dilution Factor.



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IEA
An Aquarion Company

Client: Limno-Tech
IEA Job#: CH951545
Project #: SKCH3
Matrix: Water
Method: 8240

EPA Target Compound List (TCL)
Volatile Organic Compounds
(µg/L)

Dilution Factor (DF)		5	500	1	10	1	PQL
Method Blank	Client ID	VO092695	VO092895	VO092695	VO092895	VO092695	
		GP3-7'-9'	GP3-7'-9'	GP4-2'-4'	GP4-2'-4'	GP5-2'-4'	
		DL	DL	(Water)	(Water) DL	(Water)	
Analyte	Lab ID	951545005	951545005	951546006	951545006	951546007	
Chloromethane	UD	UD	UD	U	UD	U	10
Bromomethane	UD	UD	UD	U	UD	U	10
Vinyl Chloride	60	UD	UD	8	UD	U	2
Chloroethane	45	UD	UD	64	67 J	U	10
Methylene Chloride	UD	UD	UD	U	UD	U	5
Acetone	UD	UD	UD	45	160	12	10
Carbon Disulfide	UD	UD	UD	U	UD	U	5
1,1-Dichloroethene	UD	UD	UD	U	UD	U	5
1,1-Dichloroethane	140	UD	UD	55	62	12	5
cis-1,2-Dichloroethene	650	UD	UD	6	UD	8	5
trans-1,2-Dichloroethene	UD	UD	UD	U	UD	U	5
Chloroform	UD	UD	UD	U	UD	U	5
1,2-Dichloroethane	UD	UD	UD	U	UD	U	5
2-Butanone	UD	UD	UD	U	UD	U	10
1,1, 1-Trichloroethane	UD	UD	UD	U	UD	U	5
Carbon Tetrachloride	UD	UD	UD	U	UD	U	5
Vinyl Acetate	UD	UD	UD	U	UD	U	10
Bromodichloromethane	UD	UD	UD	U	UD	U	5
1,2-Dichloropropane	UD	UD	UD	U	UD	U	5
Trans-1,3-dichloropropene	UD	UD	UD	U	UD	U	5
Trichloroethylene	UD	UD	UD	U	UD	U	5
Dibromochloromethane	UD	UD	UD	U	UD	U	5
1,1,2-Trichloroethane	UD	UD	UD	U	UD	U	5
Benzene	UD	UD	UD	19	UD	100	5
cis-1,3-Dichloropropene	UD	UD	UD	U	UD	U	5
2-Chloroethylvinylether	UD	UD	UD	U	UD	U	5
Bromoform	UD	UD	UD	U	UD	U	5
4-Methyl-2-Pentanone	UD	UD	UD	U	UD	U	10
2-Hexanone	UD	UD	UD	U	UD	U	10
Tetrachloroethylene	UD	UD	UD	U	UD	U	5
1,1,2,2-Tetrachloroethane	UD	UD	UD	U	UD	U	5
Toluene	190	UD	UD	140	170	17	5
Chlorobenzene	UD	UD	UD	U	UD	U	5
Ethylbenzene	UD	UD	UD	U	UD	240 E	5
Styrene	UD	UD	UD	U	UD	U	5
Total Xylenes	UD	UD	UD	U	UD	52	5
Tetrahydrofuran	32000 E	UD	37000	1100 E	1100	3400 E	5
1,1,2-Trichlorotrifluoroethane	UD	UD	UD	U	UD	U	10
Date Sampled	9/14/95	9/14/95	9/14/95	9/14/95	9/14/95	9/14/95	
Date Analyzed	9/26/95	9/28/95	9/26/95	9/28/95	9/27/95		

PQL = Practical Quantitation Limit
To obtain sample-specific quantitation limit, multiply the PQL by the Dilution Factor.



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IEA
An Aquarion Company

Client: Limno-Tech
IEA Job#: CH951545
Project #: SKCH3
Matrix: Water
Method: 8240

EPA Target Compound List (TCL)
Volatile Organic Compounds
(µg/L)

Analyte	Lab ID	Dilution Factor (DF)		Method Blank		Client ID	PQL
		50	1	50	1		
		VOI00295 GP5-2'-4' (Water) DL	VOO92995 GP6-2'-4' (Water)	VOO92696 GP6-2'-4' (Water) DL	VOO92795 GP7-11'-13' (Water)	VOO92795 DUPG (Water)	
Chloromethane	UD	UD	U	UD	U	U	10
Bromomethane	UD	U	UD	UD	U	U	10
Vinyl Chloride	UD	14	UD	UD	U	U	2
Chloroethane	UD	1000 E	1200	UD	U	U	10
Methylene Chloride	UD	43	UD	UD	U	U	5
Acetone	UD	110	UD	UD	U	U	10
Carbon Disulfide	UD	U	UD	UD	U	U	5
1,1-Dichloroethene	UD	U	UD	UD	U	U	5
1,1-Dichloroethane	UD	66	UD	UD	U	U	5
cis-1,2-Dichloroethene	UD	U	UD	UD	U	U	5
trans-1,2-Dichloroethene	UD	U	UD	UD	U	U	5
Chloroform	UD	U	UD	UD	U	U	5
1,2-Dichloroethane	UD	U	UD	UD	U	U	5
2-Butanone	UD	U	UD	UD	U	U	10
1,1, 1-Trichloroethane	UD	6	UD	UD	U	U	5
Carbon Tetrachloride	UD	U	UD	UD	U	U	5
Vinyl Acetate	UD	U	UD	UD	U	U	10
Bromodichloromethane	UD	U	UD	UD	U	U	5
1,2-Dichloropropane	UD	U	UD	UD	U	U	5
Trans-1,3-dichloropropene	UD	U	UD	UD	U	U	5
Trichloroethylene	UD	U	UD	UD	U	U	5
Dibromochloromethane	UD	U	UD	UD	U	U	5
1,1,2-Trichloroethane	UD	U	UD	UD	U	U	5
Benzene	UD	950 E	1900	UD	U	U	5
cis-1,3-Dichloropropene	UD	U	UD	UD	U	U	5
2-Chloroethylvinylether	UD	U	UD	UD	U	U	5
Bromoform	UD	U	UD	UD	U	U	5
4-Methyl-2-Pentanone	UD	140	UD	UD	U	U	10
2-Hexanone	UD	U	UD	UD	U	U	10
Tetrachloroethylene	UD	U	UD	UD	U	U	5
1,1,2,2-Tetrachloroethane	UD	U	UD	UD	U	U	5
Toluene	UD	1500 E	7500	UD	U	U	5
Chlorobenzene	UD	U	UD	UD	U	U	5
Ethylbenzene	220 J	6	UD	UD	U	U	5
Styrene	UD	U	UD	UD	U	U	5
Total Xylenes	UD	25	UD	UD	U	U	5
Tetrahydrofuran	2800	7300 E	9700	UD	10	U	5
1,1,2-Trichlorotrifluoroethane	UD	U	UD	UD	U	U	10
Date Sampled	9/14/95	9/14/95	9/14/95	9/14/95	9/14/95	9/14/95	
Date Analyzed	10/2/95	9/29/95	9/27/95	9/27/95	9/27/95	9/27/95	

PQL = Practical Quantitation Limit

To obtain sample-specific quantitation limit, multiply the PQL by the Dilution Factor.



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IEA
An Aquarion Company

Client: Limno-Tech
IEA Job#: CH951545
Project #: SKCH3
Matrix: Water
Method: 8240

EPA Target Compound List (TCL)
Volatile Organic Compounds
(µg/L)

Analyte	Lab ID	Dilution Factor (DF)					PQL
		1	1	100	500	1	
		Method Blank	Client ID	Method Blank	Client ID	Method Blank	
Chloromethane		U	U	UD	UD	U	10
Bromomethane		U	U	UD	UD	U	10
Vinyl Chloride		U	55	UD	UD	U	2
Chloroethane		U	34	UD	UD	U	10
Methylene Chloride		U	3800 E	28000 E	27000	U	5
Acetone		U	U	UD	UD	U	10
Carbon Disulfide		U	U	UD	UD	U	5
1,1-Dichloroethene		U	U	UD	UD	U	5
1,1-Dichloroethane		U	1400 E	4200	4300	U	5
cis-1,2-Dichloroethene		U	31	UD	UD	U	5
trans-1,2-Dichloroethene		U	8	UD	UD	U	5
Chloroform		U	U	UD	UD	U	5
1,2-Dichloroethane		U	4200 E	66000 E	60000	U	5
2-Butanone		U	22	UD	UD	U	10
1,1,1-Trichloroethane		U	3000 E	30000 E	25000	U	5
Carbon Tetrachloride		U	U	UD	UD	U	5
Vinyl Acetate		U	U	UD	UD	U	10
Bromodichloromethane		U	U	UD	UD	U	5
1,2-Dichloropropane		U	U	UD	UD	U	5
Trans-1,3-dichloropropene		U	U	UD	UD	U	5
Trichloroethylene		U	1800 E	6600	6000	U	5
Dibromochloromethane		U	U	UD	UD	U	5
1,1,2-Trichloroethane		U	7	UD	UD	U	5
Benzene		U	U	UD	UD	U	5
cis-1,3-Dichloropropene		U	U	UD	UD	U	5
2-Chloroethylvinylether		U	U	UD	UD	U	5
Bromoform		U	U	UD	UD	U	5
4-Methyl-2-Pentanone		U	U	UD	UD	U	10
2-Hexanone		U	U	UD	UD	U	10
Tetrachloroethylene		U	1200 E	3600	3700	U	5
1,1,2,2-Tetrachloroethane		U	U	UD	UD	U	5
Toluene		U	1300 E	6400	4700	6	5
Chlorobenzene		U	U	UD	UD	U	5
Ethylbenzene		U	27	UD	UD	U	5
Styrene		U	U	UD	UD	U	5
Total Xylenes		U	93	UD	UD	U	5
Tetrahydrofuran		U	16	UD	UD	U	5
1,1,2-Trichlorotrifluoroethane		U	5200 E	130000 E	190000 E	U	10
	Date Sampled	9/14/95	9/15/95	9/15/95	9/15/95	9/15/95	
	Date Analyzed	9/27/95	9/28/95	9/29/95	10/2/95	9/29/95	

PQL = Practical Quantitation Limit

To obtain sample-specific quantitation limit, multiply the PQL by the Dilution Factor.



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IEA
An Aquation Company

Client: Limno-Tech
IEA Job#: CH951545
Project #: SKCH3
Matrix: Water
Method: 8240

EPA Target Compound List (TCL)
Volatile Organic Compounds
(µg/L)

Analyte	Lab ID	Dilution Factor (DF)				PQL
		1	1	1	1	
		Method Blank	Method Blank	Method Blank	Method Blank	
Chloromethane	VO092695	VO092795	VO092895	VO092995	VO100295	10
Bromomethane	U	U	U	U	U	10
Vinyl Chloride	U	U	U	U	U	2
Chloroethane	U	U	U	U	U	10
Methylene Chloride	U	U	U	U	U	5
Acetone	U	U	U	U	U	10
Carbon Disulfide	U	U	U	U	U	5
1,1-Dichloroethene	U	U	U	U	U	5
1,1-Dichloroethane	U	U	U	U	U	5
cis-1,2-Dichloroethene	U	U	U	U	U	5
trans-1,2-Dichloroethene	U	U	U	U	U	5
Chloroform	U	U	U	U	U	5
1,2-Dichloroethane	U	U	U	U	U	5
2-Butanone	U	U	U	U	U	10
1,1, 1-Trichloroethane	U	U	U	U	U	5
Carbon Tetrachloride	U	U	U	U	U	5
Vinyl Acetate	U	U	U	U	U	10
Bromodichloromethane	U	U	U	U	U	5
1,2-Dichloropropane	U	U	U	U	U	5
Trans-1,3-dichloropropene	U	U	U	U	U	5
Trichloroethylene	U	U	U	U	U	5
Dibromochloromethane	U	U	U	U	U	5
1,1,2-Trichloroethane	U	U	U	U	U	5
Benzene	U	U	U	U	U	5
cis-1,3-Dichloropropene	U	U	U	U	U	5
2-Chloroethylvinylether	U	U	U	U	U	5
Bromoform	U	U	U	U	U	5
4-Methyl-2-Pentanone	U	U	U	U	U	10
2-Hexanone	U	U	U	U	U	10
Tetrachloroethylene	U	U	U	U	U	5
1,1,2,2-Tetrachloroethane	U	U	U	U	U	5
Toluene	U	U	U	U	U	5
Chlorobenzene	U	U	U	U	U	5
Ethylbenzene	U	U	U	U	U	5
Styrene	U	U	U	U	U	5
Total Xylenes	U	U	U	U	U	5
Tetrahydrofuran	U	U	U	U	U	5
1,1,2-Trichlorotrifluoroethane	U	U	U	U	U	10
Date Sampled	---	---	---	---	---	
Date Analyzed	9/26/95	9/27/95	9/28/95	9/29/95	10/2/95	

PQL = Practical Quantitation Limit

To obtain sample-specific quantitation limit, multiply the PQL by the Dilution Factor.



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IEA

An Aquarion Company

Client: Limno-Tech

IEA Job#: CH951545

Project #: SKCH3

Matrix: Water

Method: 8240

3-Picoline
Volatile Organic Compound
(ug/L)

Dilution Factor (DF)	1	1	1					PQL
	Method Blank	VO092795	VO092795	VO092795				
	Client ID	Rinse Blank 1	GP3-7'-9'	Method Blank				
	Analyte	Lab ID	951545002	951545005	VO092795			
3-Picoline	U	4400	U					1000
Date Sampled	9/13/95	9/13/95	---					
Date Analyzed	9/27/95	9/27/95	9/27/95					

PQL = Practical Quantitation Limit

To obtain sample-specific quantitation limit, multiply the PQL by the Dilution Factor.



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IEA
An Aquarion Company

Client: Limmo - Tech
IEA Job#: CH951545
Project #: SKCH3

SEMI-VOLATILE ORGANIC LIST

Matrix: Water
Method: 8270

ug / L

Dilution Factor (DF)	1.0	1.1	1.3	6.5	1.0	PQL
Method Blank	SW0919	SW0920	SW0919	SW0919	SW0920	
Client ID	Rinse Blank	Rinse Blank	GP3 (7-9)	GP3 (7-9)	GP4 (2-4)	
Lab ID	951545	951545	951545	951545	951545	
Analyte	002	004	005	005 DL	006	
Phenol	U	U	U	UD	U	10
1,2-Dichlorobenzene	U	U	U	UD	U	10
2-Methylnaphthalene	U	U	U	UD	U	10
Phenanthrene	U	U	U	UD	U	10
Benzo(a)anthracene	U	U	U	UD	U	10
Chrysene	U	U	U	UD	U	10
bis(2-ethylhexyl)phthalate	14	13	U	UD	U	10
Benzyl Alcohol	U	U	U	UD	U	10
Benzoic Acid	U	U	U	UD	U	50
2-Methylphenol	U	U	U	UD	U	10
4-Methylphenol	U	U	U	UD	U	10
Isophorone	U	U	U	UD	U	10
2,4-Dimethylphenol	U	U	U	UD	U	10
Isophorone	U	U	U	UD	U	10
2,4-Dimethylphenol	U	U	U	UD	U	10
Naphthalene	U	U	U	UD	U	10
4-Chloro-3-methylphenol	U	U	U	UD	U	10
2,6-Dinitrotoluene	U	U	U	UD	U	10
Acenaphthene	U	U	U	UD	U	10
Dibenzofuran	U	U	U	UD	U	10
Fluorene	U	U	U	UD	U	10
Pyridine	N/A	U	N/A	UD	160	10
3-Picoline	N/A	U	N/A	UD	4100E	10
1-Methyl-2-Pyrrolidinone	U	U	91	170	470E	10
N,N-Dimethylacetamide	U	U	29	UD	130	10
Acetophenone	U	U	U	UD	U	10
2-Chlorophenol	U	U	U	UD	U	10
2-Nitrophenol	U	U	U	UD	U	10
2,4-Dichlorophenol	U	U	U	UD	U	10
2,4,6-Trichlorophenol	U	U	U	UD	U	10
2,4,5-Trichlorophenol	U	U	U	UD	U	50
2,4-Dinitrophenol	U	U	U	UD	U	50
4-Nitrophenol	U	U	U	UD	U	50
4,6-Dinitro-2-methylphenol	U	U	U	UD	U	50
Pentachlorophenol	U	U	U	UD	U	50
Date Extracted	09/19/95	09/20/95	09/19/95	09/19/95	09/20/95	
Date Analyzed	09/28/95	09/28/95	09/29/95	09/29/95	09/28/95	

PQL = Practical Quantitation Limit

To obtain sample - specific quantitation limit, multiply the PQL by the Dilution Factor.



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IEA

An Aquarion Company

Client: Limno - Tech
IEA Job #: CH951545
Project #: SKCH3

SEMI-VOLATILE ORGANIC LIST

ug/L

Matrix: Water
Method: 8270

Dilution Factor (DF)	2.0	50.0	1.16	1.0	2.0	PQL
	SW0920 GP4 (2-4)	SW0920 GP4 (2-4)	SW0920 GP5 (2-4)	SW0920 GP6 (2-4)	SW0920 GP6 (2-4)	
Method Blank	GP4	GP4	GP5	GP6	GP6	
Client ID	951545	951545	951545	951545	951545	
Analyte	Lab ID	006 DL1	006 DL2	007	008	008 DL1
Phenol	UD	UD	11	U	UD	10
1,2-Dichlorobenzene	UD	UD	U	U	UD	10
2-Methylnaphthalene	UD	UD	U	U	UD	10
Phenanthrene	UD	UD	60	U	UD	10
Benzo(a)anthracene	UD	UD	23	U	UD	10
Chrysene	UD	UD	24	U	UD	10
bis(2-ethylhexyl)phthalate	UD	UD	U	U	UD	10
Benzyl Alcohol	UD	UD	U	U	UD	10
Benzoic Acid	UD	UD	U	U	UD	50
2-Methylphenol	UD	UD	U	88	93	10
4-Methylphenol	UD	UD	U	120	130	10
Isophorone	UD	UD	U	U	UD	10
2,4-Dimethylphenol	UD	UD	U	U	UD	10
Naphthalene	UD	UD	54	U	UD	10
4-Chloro-3-methylphenol	UD	UD	U	U	UD	10
2,6-Dinitrotoluene	UD	UD	U	U	UD	10
Acenaphthene	UD	UD	U	U	UD	10
Dibenzofuran	UD	UD	U	U	UD	10
Fluorene	UD	UD	U	U	UD	10
Pyridine	150	UD	U	49	52	10
3-Picoline	5700E	8600	U	6600E	8400E	10
1-Methyl-2-Pyrrolidinone	470	UD	U	4300E	5200E	10
N,N-Dimethylacetamide	99	UD	U	410E	470	10
Acetophenone	UD	UD	U	U	UD	10
2-Chlorophenol	UD	UD	U	U	UD	10
2-Nitrophenol	UD	UD	U	U	UD	10
2,4-Dichlorophenol	UD	UD	U	U	UD	10
2,4,6-Trichlorophenol	UD	UD	U	U	UD	10
2,4,5-Trichlorophenol	UD	UD	U	U	UD	50
2,4-Dinitrophenol	UD	UD	U	U	UD	50
4-Nitrophenol	UD	UD	U	U	UD	50
4,6-Dinitro-2-methylphenol	UD	UD	U	U	UD	50
Pentachlorophenol	UD	UD	U	U	UD	50
Date Extracted	09/20/95	09/20/95	09/20/95	09/20/95	09/20/95	
Date Analyzed	09/29/95	10/02/95	09/28/95	09/28/95	09/29/95	

PQL = Practical Quantitation Limit

To obtain sample - specific quantitation limits, multiply the PQL by the Dilution Factor.



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IEA
An Aquarion Company

Client: Limno-Tech
IEA Job #: CH951545
Project #: SKCH3

SEMI-VOLATILE ORGANIC LIST

Matrix: Water
Method: 8270

ug / L

Dilution Factor (DF)	50.0	1.0	1.0	1.0	1.0	PQL
Method Blank	SW0920 GP6 (2-4)	SW0920 GP7 (11-13)	SW0920 DUPG WATER 010	SW0920 GP8 (4-6)	SW0920 GP9 (9-11)	
Client ID	951545	951545	951545	951545	951545	
Analyte	Lab ID 008 DL2	009	010	011	012	
Phenol	UD	U	U	U	U	10
1,2-Dichlorobenzene	UD	U	U	U	130	10
2-Methylnaphthalene	UD	U	U	U	U	10
Phenanthrene	UD	U	U	U	U	10
Benzo(a)anthracene	UD	U	U	U	U	10
Chrysene	UD	U	U	U	U	10
bis(2-ethylhexyl)phthalate	UD	U	21	U	U	10
Benzyl Alcohol	UD	U	U	U	U	10
Benzoic Acid	UD	U	U	U	U	50
2-Methylphenol	UD	U	U	U	U	10
4-Methylphenol	UD	U	U	U	U	10
Isophorone	UD	U	U	U	U	10
2,4-Dimethylphenol	UD	U	U	U	U	10
Naphthalene	UD	U	U	U	U	10
4-Chloro-3-methylphenol	UD	U	U	U	U	10
2,6-Dinitrotoluene	UD	U	U	U	U	10
Acenaphthene	UD	U	U	U	U	10
Dibenzofuran	UD	U	U	U	U	10
Fluorene	UD	U	U	U	U	10
Pyridine	UD	U	U	U	U	10
3-Picoline	11000	U	U	U	U	10
1-Methyl-2-Pyrrolidinone	5000	U	U	U	U	10
N,N-Dimethylacetamide	UD	U	U	U	U	10
Acetophenone	UD	U	U	U	U	10
2-Chlorophenol	UD	U	U	U	U	10
2-Nitrophenol	UD	U	U	U	U	10
2,4-Dichlorophenol	UD	U	U	U	U	10
2,4,6-Trichlorophenol	UD	U	U	U	U	10
2,4,5-Trichlorophenol	UD	U	U	U	U	50
2,4-Dinitrophenol	UD	U	U	U	U	50
4-Nitrophenol	UD	U	U	U	U	50
4,6-Dinitro-2-methylphenol	UD	U	U	U	U	50
Pentachlorophenol	U	U	U	U	U	50
Date Extracted	09/20/95	09/20/95	09/20/95	09/20/95	09/20/95	
Date Analyzed	09/29/95	09/28/95	09/28/95	09/28/95	09/28/95	

PQL = Practical Quantitation Limit

To obtain sample -- specific quantitation limits, multiply the PQL by the Dilution Factor.



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IEA
An Aquation Company

Client: Limmo-Tech
IEA Job#: CH951545
Project #: SKCH3

SEMIVOLATILE ORGANIC LIST
ug/L

Matrix: Water
Method: 8270

Dilution Factor (DF)	1.09	1.0	1.0					PQL
	Method Blank	SW0920	SW0919					
Analyte	Client ID	Rinse Blank 3	Method Blank	Method Blank				
	951545							
Lab ID	013	SW0920	SW0919					
Phenol	U	U	U					10
1,2-Dichlorobenzene	U	U	U					10
2-Methylnaphthalene	U	U	U					10
Phenanthrene	U	U	U					10
Benzo(a)anthracene	U	U	U					10
Chrysene	U	U	U					10
bis(2-ethylhexyl)phthalate	U	U	U					10
Benzyl Alcohol	U	U	U					10
Benzoic Acid	U	U	U					50
2-Methylphenol	U	U	U					10
4-Methylphenol	U	U	U					10
Isophorone	U	U	U					10
2,4-Dimethylphenol	U	U	U					10
Naphthalene	U	U	U					10
4-Chloro-3-methylphenol	U	U	U					10
2,6-Dinitrotoluene	U	U	U					10
Acenaphthene	U	U	U					10
Dibenzofuran	U	U	U					10
Fluorene	U	U	U					10
Pyridine	U	U	U					10
3-Picoline	U	U	1					10
1-Methyl-2-Pyrrolidinone	U	U	U					10
N,N-Dimethylacetamide	U	U	U					10
Acetophenone	U	U	U					10
2-Chlorophenol	U	U	U					10
2-Nitrophenol	U	U	U					10
2,4-Dichlorophenol	U	U	U					10
2,4,6-Trichlorophenol	U	U	U					10
2,4,5-Trichlorophenol	U	U	U					50
2,4-Dinitrophenol	U	U	U					50
4-Nitrophenol	U	U	U					50
4,6-Dinitro-2-methylphenol	U	U	U					50
Pentachlorophenol	U	U	U					50
Date Extracted	09/20/95	09/20/95	09/21/95					
Date Analyzed	09/28/95	09/28/95	09/28/95					

PQL = Practical Quantitation Limit

To obtain sample – specific quantitation limit, multiply the PQL by the Dilution Factor.



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Attachment F.
PSI Laboratory Report for September 1995 Permeameter Testing of
Geoprobe Soil Samples GP6 (5.5'-7') and GP8 (6'-8')



Professional Service Industries, Inc.

REPORT OF MEASUREMENT OF HYDRAULIC CONDUCTIVITY OF SATURATED POROUS MATERIAL USING A FLEXIBLE WALL PERMEAMETER - ASTM D-5084-90

TESTED FOR: LTI Environmental Engineering PROJECT: Safety Kleen
501 Avis Drive Chicago Recycle Center
Ann Arbor, Michigan 48108
Attention: Mr. Brian D. Lord OCT 17 1995

DATE: September 27, 1995 OUR REPORT NO.: 407-50083-1

REMARKS:

On September 19, 1995, Mr. Brian D. Lord of LTI Environmental Engineering delivered two (2) soil samples to the Professional Service Industries, Inc. laboratory for permeability testing. Please see the following for the results of those tests.

SAMPLE DATA:		GP-6	GP-8
Sample Type	Undisturbed Tube Sample *	Undisturbed Tube Sample *	
(5.5'-7.0')			
Sample Height(Inches)			
Initial	5.55	5.55	
Final	5.20	5.20	
Sample Diameter(Inches)			
Initial	2.8	2.8	
Final	3.2	3.2	
Hydraulic Conductivity			
(cm/sec)	1.0×10^{-7}	7.22×10^{-8}	

* Unable to extrude the sample undisturbed, therefore, sample was remolded.

SOIL DESCRIPTION: Very soft, black, organic SILTY CLAY (OL), some fine to coarse sand, trace gravel, wet

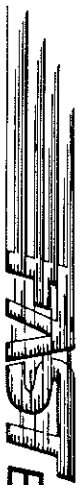
- 1) De-Aired tap water was used as the permeant liquid.
- 2) Temperature was maintained at or near 20 degrees celsius.
- 3) Degree of saturation: 99.0%

Respectfully submitted,

PROFESSIONAL SERVICE INDUSTRIES, INC.

Attachment G.

FAST Environmental Report for September, 1995 Groundwater Field Screening Data



J&S ENVIRONMENTAL

FIELD ANALYTICAL SERVICE TEAM

ANALYTICAL REPORT

Page 1 of 4

Client: LTI
Project: SKC RC
Location: Chicago, IL
Sampled By: B. Betz

Description: water
Sample Date: 9/13/95
Analysis Date: 9/13/95
Analyst: DW

	GP-1 9-11'	GP-3 7-9'
Vinyl chloride	<5	<50
1,1-Dichloroethene	<2	<20
1,2-Dichloroethene	<2	988
1,1,1-Trichloroethane	<10	<100
Trichloroethene	<1	25
Tetrachloroethene	<1	15
Benzene	<1	<10
Ethyl benzene	<2	<20
toluene	<2	294
Xylene (total)	<3	<30
Chlorobenzene	<10	<100
Styrene	<10	<100
Tetrahydrofuran	<250	52000
Trichlorotrifluoroethane	<25	<250

Notes:

*

values expressed in - ug/L (parts per billion)

* - Unidentified compounds present

Lab Manager





ENVIRONMENTAL

FIELD ANALYTICAL SERVICE TEAM

ANALYTICAL REPORT

Page 2 of 4

Client: LTI
Project: SKC RC
Location: Chicago, IL
Sampled By: B. Betz

Description: water
Sample Date: 9/14/95
Analysis Date: 9/14/95
Analyst: DW

	GP-4 2-4'	GP-4 2-4' DUP.	OFDW Blank	GP-5 2-4'	OFDW Blank	GP-6 2-4'
Vinyl chloride	<5	<5	<5	NA	<5	NA
1,1-Dichloroethene	<2	<2	<2	<2	<2	<2
1,2-Dichloroethene	14	12	<2	2	<2	<100
1,1,1-Trichloroethane	<10	<10	<10	<10	<10	<100
Trichloroethene	2	<1	<1	6	<1	13
Tetrachloroethene	3	<1	<1	<10	<1	<10
Benzene	8	11	<1	84	<1	1260
Ethyl benzene	<2	<2	<2	324	<2	2
toluene	105	132	<2	<100	<2	5770
Xylene (total)	<3	<3	<3	311	<3	13
Chlorobenzene	<10	<10	<10	NA	<10	<10
Styrene	<10	<10	<10	NA	<10	<10
Tetrahydrofuran	465	522	<250	NA	<250	NA
Trichlorotrifluoroethane	<25	<25	<25	<25	<25	<25

Notes:

*

*

*

*

values expressed in - ug/L (parts per billion)

* - Unidentified compounds present

NA - Not attainable due to interferences

Lab Manager





J&S ENVIRONMENTAL

FIELD ANALYTICAL SERVICE TEAM

ANALYTICAL REPORT

Page 3 of 4

Client: LTI
Project: SKC RC
Location: Chicago, IL
Sampled By: B. Betz

Description: water
Sample Date: 9/14/95
Analysis Date: 9/14/95
Analyst: DW

	Ambient	GP-8	OFDW	GP-7
	Air Blank	4-6'	Blank	11-13'
Vinyl chloride	<5	<5	<5	<5
1,1-Dichloroethene	<2	<2	<2	<2
1,2-Dichloroethene	<2	<2	<2	<2
1,1,1-Trichloroethane	<10	<10	<10	<10
Trichloroethene	<1	<1	<1	<1
Tetrachloroethene	<1	<1	<1	<1
Benzene	<1	<1	<1	<1
Ethyl benzene	<2	<2	<2	<2
toluene	<2	<2	<2	<2
Xylene (total)	<3	<3	<3	<3
Chlorobenzene	<10	<10	<10	<10
Styrene	<10	<10	<10	<10
Tetrahydrofuran	<250	<250	<250	<250
Trichlorotrifluoroethane	<25	<25	<25	<25

Notes:

values expressed in - ug/L (parts per billion)


Lab Manager





ENVIRONMENTAL

FIELD ANALYTICAL SERVICE TEAM

ANALYTICAL REPORT

Page 4 of 4

Client: LTI
Project: SKC RC
Location: Chicago, IL
Sampled By: B. Betz

Description: water
Sample Date: 9/15/95
Analysis Date: 9/15/95
Analyst: DW

	GP-9 11-13'	OFDW Blank	GP-10 10-12'
Vinyl chloride	NA	<5	<5
1,1-Dichloroethene	<200	<2	<2
1,2-Dichloroethene	<200	<2	<2
1,1,1-Trichloroethane	88200	<10	<10
Trichloroethene	13300	<1	<1
Tetrachloroethene	15800	<1	<1
Benzene	NA	<1	<1
Ethyl benzene	33	<2	<2
toluene	12500	<2	<2
Xylene (total)	70	<3	<3
Chlorobenzene	<100	<10	<10
Styrene	<100	<10	<10
Tetrahydrofuran	NA	<250	<250
Trichlorofluoroethane	>100000	<25	<25

Notes:

*

values expressed in - ug/L (parts per billion)

NA - Not attainable due to interferences

* - Unidentified compounds present


Lab Manager



**RCRA FACILITY INVESTIGATION
PHASE II WORKPLAN**

**Safety-Kleen Corporation
Chicago Recycle Center
Cook County, Illinois**

USEPA ID No. **ILD005450697**
IEPA ID No. 0316000053

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USEPA - REGION 5
PERMIT SECTION

Prepared for:
**Safety Kleen Corporation
Elgin, IL**

Prepared by:
**LTI, Limno-Tech, Inc.
Ann Arbor, MI**

March, 1995

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Attachment D.	IEPA Groundwater Sampling Procedures
Attachment E.	Decontamination Procedures for Groundwater Sampling
Attachment F.	IEPA Guidance for Demonstrating Groundwater is Class II Groundwater
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1. INTRODUCTION

This workplan has been prepared by Limno-Tech, Inc. (LTI) on behalf of Safety-Kleen Corp. (Safety-Kleen) to satisfy requirements of Section IV.C of the RCRA Hazardous Waste Management Part B permit (the permit) for the Safety-Kleen Chicago Recycle Center (CRC). This workplan presents the proposed investigation tasks for the Phase II RCRA Facility Investigation (RFI) to be conducted at the CRC. This workplan is being submitted to the Illinois Environmental Protection Agency (IEPA) for review, comment and approval.

Section IV.C of the RCRA Hazardous Waste Management Part B permit requires that a Phase II RFI be conducted upon written request from the IEPA, if the IEPA determines (based on the results of a Phase I investigation) that there has been a release of hazardous waste or hazardous constituents to the environment, or that the data is inconclusive. In July 1994, a Phase I RFI Report was submitted to the IEPA in accordance with the permit. In their September 30, 1994 response to the Phase I RFI Report, IEPA requested the development of a Phase II RFI Workplan for further investigation of certain solid waste management units (SWMUs) at the CRC. The SWMUs at the CRC referenced by IEPA consist of:

- the area in the vicinity of Container Storage Area #1; and,
- the area in the vicinity of Tank Farms #2 and #3.

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The Phase II RFI Workplan is required as the next step in the corrective action process under the permit and as requested by IEPA. Also as requested in IEPA's September 30, 1994 response letter to the Phase I RFI Report, this Workplan contains a proposal for groundwater classification in accordance with 35 IAC Part 620.

Attachment G to the permit establishes the requirements for conducting the RFI. The scope of the RFI as specified in the permit is divided into two phases (Phase I and Phase II). The purpose of the Phase I RFI was to determine whether or not any releases occurred from the identified SWMUs. The Phase I RFI activities also provided for collection of data beyond the scope required by the permit. Elements of the Phase I investigation provided data regarding the nature, extent, and distribution of chemicals in soil and groundwater, in addition to determining whether or not a release occurred. Therefore, the Phase I activities satisfied the objectives of a Phase I RFI, as well as provided preliminary information related to the Phase II objectives. Additional Phase II investigations are required to determine the horizontal and vertical extent of hazardous waste or hazardous constituents detected in soil and groundwater, the rate and extent of migration of hazardous waste or hazardous constituents and the concentrations of the

hazardous waste or hazardous constituents in the groundwater and soils. Based upon the additional Phase II investigation results, IEPA may then require a corrective measures study.

The contents of this workplan includes:

- A summary of background information on the CRC;
- A summary of the results of the Phase I investigations;
- A summary of available information regarding potential migration pathways;
- The administrative outline and project management plan;
- A description of the work plan investigation elements (scope of work and tasks) and a proposal for groundwater classification in accordance with 35 IAC Part 620; and
- A description of reporting activities, including a tentative schedule.

Additional background information on the facility and details on the results of past hydrogeological investigations at the CRC are provided in the June 30, 1994 Phase I RFI Report. Associated plans that will be employed for data collection and management are included as attachments to the May, 1993 Phase I Workplan (as modified by the IEPA September 23, 1993 qualified approval letter) and include a Data Management Plan (DMP), a Quality Assurance/Program Plan (QAPP), and a personnel Health and Safety Plan (HASP). In addition, this Workplan includes attachments describing data collection and analysis plans specified in the September 23, 1993 IEPA qualified approval letter that were not included in the Phase I Workplan. The scope and content of the workplan documents have been structured to be consistent with and meet the requirements contained in Attachment G of the Part B Permit for the CRC.

2. CRC LOCATION AND BACKGROUND

The following sections summarize background information on the CRC, including location, present facility operations, historical facility operations, a description of the SWMU areas and a description of surrounding areas. Additional information is provided in the May, 1993 Phase I RFI Work Plan and the June 30, 1994 Phase I RFI Report.

2.1 LOCATION

The Chicago Recycle Center (CRC) is located within the city limits of Chicago, Cook County, Illinois between 42nd Street and 43rd Street, approximately 1000 feet east of Ashland Avenue. Figures 1 and 2 depict the CRC on a regional USGS topographic map and a site topographic map, respectively. The CRC occupies approximately eight acres of land in the Chicago Stockyards, an area with a long history of industrial use. The present land use is characterized as urban commercial/industrial.

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2.2 PRESENT FACILITY OPERATIONS

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The CRC is an organic chemicals reclamation and recycling facility permitted to treat and store hazardous wastes under a RCRA Hazardous Waste Management Part B permit (effective November 4, 1992). The permit consists of a RCRA permit issued by IEPA under Title 35 of the State of Illinois Rules and Regulations and a Hazardous Waste Management Permit issued by USEPA under the Hazardous and Solid Waste Amendments of 1984 to RCRA (HSWA).

The CRC accepts organic chemicals and solvent wastes from industrial and commercial facilities. Reclamation and recycling operations involve either regeneration of the spent solvent or blending and processing of the material for use as a hazardous waste fuel. Wastes accepted at the facility include organic acids, chlorinated and fluorinated hydrocarbons, amines, alcohols, aliphatic and aromatic compounds, waste oils, and paint wastes. The facility serves a variety of industries including chemical manufacturers, paint manufacturers, pharmaceutical manufacturers, electronics manufacturers, maintenance shops, metal fabricators, and foundries. Processes utilized in the reclamation of used solvents, solvent mixtures, and other solvent containing wastes include neutralization, distillation, fractionation, liquid-liquid extraction, and drying.

Tank farms and container storage areas are used to manage or store a variety of compounds at the CRC. The list of materials managed or stored in a particular unit may vary from day to day.

Hazardous wastes are received at the CRC in containers via trucks. All containers are stored in Container Storage Area No. 1 (see Figure 3). Container Storage Area No. 1 is constructed with secondary containment for spill and leak control, and has a maximum hazardous waste storage capacity of 108,900 gallons. The wastes that are permitted to be stored in Container Storage Area No. 1 are listed in Attachment A of the RCRA Part B permit. Other container storage areas are used for the storage of product.

There are five existing tank farms at the CRC, originally containing 82 above-ground tanks, 14 of which have been removed. Of the 68 remaining tanks, 59 are subject to RCRA regulations.

2.3 HISTORICAL FACILITY OPERATIONS

The use of the CRC property prior to 1969 is unknown but likely associated with livestock processing. A 1901 Sanborn map indicates that a structure called a Meat Preserving and Cooling House once occupied the site. Between 1969 and 1985, the site was owned and operated by Custom Organics for industrial chemical processing. Safety-Kleen acquired the site in 1985 for its current use as a recycling center.

Between 1969 and 1985, when the facility was owned and operated by Custom Organics, only Tank Farm No. 3 was in existence. No records are available documenting the use of the tanks. According to the Safety-Kleen CRC manager, who was employed by Custom Organics between 1981 and 1985, the tanks were used for a variety of purposes, including the storage of hazardous waste, in-process material, product, and wastewater. A partial list of chemicals handled by Custom Organics included: dimethyl acetamide; gamma butyrolactone; methylene chloride; n-methyl pyrrolidinone; toluene; 1,1,1-trichloroethane; and trichlorotrifluoroethane.

After Safety-Kleen purchased the facility in 1985, the present tank farms and container storage areas were constructed. The use of Tanks Nos. T190 through T193 in Tank Farm No. 3 for the storage of hazardous waste, in-process material, and product was discontinued, and in 1991 they were removed under an approved RCRA closure plan.

2.4 DESCRIPTION OF THE SWMU AREAS

As required by Section IV.B of the RCRA Hazardous Waste Management Part B permit, a Phase I RFI was conducted for two SWMU areas at the CRC, including: 1) the area north and west of the Container Storage Area #1; and 2) the area south of Tank Farms #2 and #3. The extent of these SWMU areas is shown in Figure 4. These areas presently do not contain any building structures or fixed equipment.

The SWMU areas reportedly have been in their present state (without building or equipment structures) since at least 1969. Subsurface obstructions encountered in the SWMU areas during previous soil investigations were characterized as old building foundations and, therefore, suggest that buildings were once present in portions of the SWMU areas. As mentioned above, the CRC is in the Chicago Stockyard area, and was the site for historical operations related to livestock processing.

No materials are presently managed or stored at the two SWMU areas. However, historical spills have been reported for the SWMU areas. IEPA Land Division files indicate that open drums containing waste material and rain water were observed in storage in the area south of Tank Farm No. 3 on September 9, 1981, prior to Safety-Kleen ownership. A spill of semi-solid waste material was observed in this area on October 10, 1982, also prior to ownership by Safety-Kleen. Safety-Kleen documented a spill of 20 gallons of trichlorotrifluoroethane (freon-113) which occurred on July 22, 1987, in the area on the west side of Container Storage Area No. 1. The area was uncontained, and impacted soil was excavated at that time.

For areas adjacent to the SWMU areas, specifically Tank Farm #3, closure activities have been conducted. Between April and July, 1991, Tank Nos. 190 through 193 in Tank Farm #3 were removed from service and closed by Safety-Kleen. According to the closure report (Canonie, 1991) the four above-ground steel tanks were emptied, cleaned, and decontaminated, then the tanks were removed and recycled as scrap metal. The concrete slabs on which the four tanks had rested were removed, as were the northern and western walls of the concrete containment dike.

2.5 DESCRIPTION OF SURROUNDING AREAS

As illustrated in Figure 2, land use in the area surrounding the CRC is urban commercial/industrial. Immediately to the east of the facility are Rosebud (manufacturers of boxes and containers) and an Illinois Air Emission Station. The Ashland Cold Storage warehouse is located immediately to the west of the facility. Immediately to the south of the facility is West 43rd Street and Cameo Containers.

Due to the exclusively urban/industrialized nature of the area in the vicinity of the CRC, there are no natural environmental systems, such as surface water bodies or wetlands, which would be potentially threatened by a release from the SWMU areas. Similarly, residential exposure to potential releases in the area is minimal. Nearby human populations potentially exposed to potential releases from the SWMU areas would be limited to workers at the CRC and the adjacent industries. The operational portion of the site is completely fenced.

3. SUMMARY OF PHASE I RFI RESULTS

Existing information on the site geology, hydrogeology and degree and extent of impacts at the CRC has been obtained from three separate sampling events conducted in association with the closure of four tanks (Tank Nos. 190 through 193) at Tank Farm No. 3 in 1991 and from the Phase I RFI and additional hydrogeological investigations conducted in late 1993 through 1994. These investigations included:

- Soil sampling in February 1991 (Canonie Environmental);
- A soil gas survey and temporary well sampling in May 1991 (RMT, Inc.);
- Soil and groundwater sampling in October 1991 (Canonie, 1991);
- Soil and groundwater sampling in December, 1993 (LTI);
- In-situ hydraulic conductivity testing in February, 1994 (LTI) and short term qualitative pumping tests in monitoring wells MW8 and MW10 (October 4, 1994);
- Groundwater sampling in February and May, 1994 (LTI);
- Static water level monitoring in December, 1993 and February, May and October, 1994 (LTI).

Reports summarizing the results of investigations conducted through May, 1994 were previously submitted to the IEPA in November and December, 1991, and January, April and July, 1994 (see list of references in Section 8). These studies provided preliminary information regarding site characteristics and the nature and extent of impacts in soil and groundwater. This information will be supplemented by the data obtained during the proposed Phase II RFI.

The following sections summarize the results of hydrogeological investigations conducted at the CRC, including a description of the site geology, site hydrogeology, and the nature and extent of impacts in soil and groundwater. Additional information is provided in the May, 1993 Phase I RFI Work Plan and the June 30, 1994 Phase I RFI Report (including background information regarding regional geology and hydrogeology).

3.1 GEOLOGY

The site geology has been characterized by information from ten 1991 shallow onsite soil borings, regional supply wells and information from eight site borings installed in December, 1993 during the Phase I investigations. The 1991 borings were drilled to a depth of ten feet, with one boring extending to a depth of twenty feet. The seven shallow 1993 Phase I borings (SB4 through SB10) were characterized continuously to a maximum depth of twenty-one feet below grade, and one deep boring (SB5deep) was characterized continuously during the Phase I investigations from twenty to sixty feet below grade. The locations of all monitoring wells and soil borings installed at the CRC are depicted in Figure 5.

Over 60 feet of unconsolidated sand, silt, and clay of glaciolacustrine origin overlay consolidated deposits of the Paleozoic Era at the site. The unconsolidated deposits consist of an upper fill layer, between one and seven feet thick, composed of sand, gravel, soil, concrete, and wood debris. Below the fill layer there is an average of five to six feet (up to thirteen feet) of apparently indigenous clayey silt to silty clay, which grades downward into a laterally extensive stiff, dark-grayish brown fine-laminated lakebed clay. The top of the clay unit occurs at an average depth of ten feet below grade across the area of investigation (see Figure 8). The clay exists as deep as sixty feet below grade at the western side of the site, in the vicinity of SB5/MW5, and contains a thin saturated muddy silt zone at approximately 37 to 38 feet below grade and a thin saturated silty mud zone at 50.5 feet below grade.

The horizontal extent of the non-indigenous fill zone occurred throughout the area of investigation. The fill material is thinnest in the vicinity of Tank Farm #3, where it overlies a subsurface mounding in the clayey silt/silty clay zone and the lower clay unit.

3.2 HYDROGEOLOGY

The groundwater resources of Chicago and surrounding Cook County are developed from four aquifer or saturated systems: glacial drift saturated or water bearing units, shallow dolomite aquifers mainly of Silurian age, the Cambrian-Ordovician aquifer composed of the Galena-Platteville dolomite, St. Peter sandstone, and Ironton-Galesville sandstone formations, and the Mt. Simon aquifer consisting of the Mt. Simon-Eau Claire sandstone formations. Water wells exist in the city, but are used mainly for process and cooling water for industry. The City of Chicago obtains its potable water from Lake Michigan, withdrawing over one billion gallons per day (ISGS, 1984).

The results of the hydrogeological investigations indicate that a water table exists at approximately 3 to 5 feet below grade at the site. The shallow, unconfined saturated zone below the water table is comprised of the fill material and clayey silt to silty clay soils overlying the lower clay unit. The base of the shallow saturated zone is defined by the clay unit which occurs at approximately ten feet below grade throughout the site. The saturated thickness of the shallow unconfined zone varies between approximately five and eight feet, but generally is five to six feet thick throughout most of the investigation area. The saturated thickness appears to be greatest in the vicinity of the north end of Container Storage Area #1, near monitoring wells MW8 and MW10, and in the vicinity of MW2 on the north side of Tank Farm #3.

Table 1 summarizes the static water level data and well construction information for the site monitoring wells. Figure 6 depicts the potentiometric surface interpreted from the October 4, 1994 static water level data. These data indicate that groundwater flow directions vary across the site. A water table mound appears to exist consistently in the vicinity of Tank Farm #3, and, to the east of this water table mound, groundwater flow appears to converge from the east, south and west towards Tank Farm #2 and away from Container Storage Area #1. The static water level data indicate that the direction of groundwater flow ultimately moves to the north, away from the vicinity of Tank Farm #2; however, additional information is needed to the north of Tank Farm #2 to confirm this initial interpretation. Groundwater flow directions appear to be related to the subsurface structure of the clay unit underlying the saturated zone. Significant variations in groundwater flow direction due to seasonal changes or responses to precipitation also are indicated. In general, the horizontal groundwater gradient at the site varies from approximately 0.02 to 0.04 feet/foot on the eastern and western sides of the site, respectively.

Hydraulic conductivity testing indicates that the permeability of the clayey silt/silty clay unit varies from 2.46×10^{-5} cm/sec in monitoring well MW2 on the western side of the site to 8.16×10^{-4} cm/sec in monitoring well MW8 on the eastern side of the site. The average permeability of the clay is 2.4×10^{-8} cm/sec. Using the range of horizontal groundwater gradients presented above and an estimated effective porosity of 0.2 for the clayey silt/silty clay zone, the estimated groundwater flow velocity in the saturated section appears to range from 2.5 to 170 feet/year. These relatively slow groundwater velocities are consistent with the observed tendency of site wells to recharge very slowly during development and are consistent with the results of the short term pumping tests conducted in monitoring wells MW8 and MW10 on October 4, 1994. Although MW8 and MW10 were selected for hydraulic conductivity testing because they are not as slow to recharge as other site wells, both MW8 and MW10 went dry if pumped above approximately 3 to 9 gallons per minute (MW8) or approximately 1 gallon per minute (MW10).

The shallow saturated zone is not used as an aquifer at the site, and no water withdrawal wells are known to exist within 1500 feet of the CRC. Regional bedrock aquifers underlie the lower clay unit. There is no evidence that chemicals resulting from site releases are present in the bedrock aquifers.

3.3 NATURE AND EXTENT OF IMPACTS

Chemical constituents have been detected in shallow soil and groundwater in the vicinities of the SWMUs: volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs) and metals (at apparently naturally occurring levels) were detected in soil and groundwater samples. Groundwater samples were collected from the monitoring well with the highest concentrations of VOCs and SVOCs (MW2) and analyzed for a wide range of parameters, including PCBs, sulfides, cyanides, dioxin and furans. No PCBs, sulfides, cyanide, dioxins or furans were detected in the groundwater samples collected from monitoring well MW2.

The vertical distribution of soil and groundwater impacts has been determined preliminarily, and is limited to a depth of 20 feet below grade throughout most of the area of investigation. Some additional confirmatory sampling is needed in the vicinity of Container Storage Area #1 to confirm the vertical and horizontal extent. The horizontal extent and distribution of chemicals in soil and groundwater generally is defined in the southern and western sides of the area of investigation. Further investigations are proposed in this workplan to determine the northern and eastern horizontal extent and distribution of chemicals in soil and groundwater.

The following subsections summarize the types and concentrations of chemicals detected in soil and groundwater, the extent and distribution of impacts in soil and groundwater, and physicochemical characteristics for compounds detected in soil and groundwater.

3.3.1 Soil Impacts

The results of the Phase I RFI provided preliminary information regarding the occurrence and types of inorganic and organic chemicals detected in soil at the CRC, chemical concentrations, and the vertical and horizontal extent of the detected chemicals.

Detected Chemicals and Occurrence. Organic compounds were detected in soil samples collected off the northwest corner of Tank Farm #3, along the north and west side of Container Storage Area #1, and in the southwest corner of the CRC property. No inorganic compounds were detected in the soil TCLP samples with the exception of barium, which is a metal that naturally occurs in Illinois soil at concentrations as high as 805 mg/kg (ISGS, personal communication).

Table 2 summarizes the inorganic compounds, VOCs and SVOCs detected in soil samples collected at the CRC. Detected VOCs in soil consisted of chlorinated and non-chlorinated hydrocarbons.

Concentrations of Chemicals in Soil. Based on the 1993 Phase I RFI results, the highest concentration of total VOCs that occurred in a single soil sample was detected in SB8 (17.5'-18.5') at 326 mg/kg, and the lowest total VOC concentration occurred in SB5 (18.5'-20'), which was non-detected for VOCs. The next highest total VOCs concentrations were significantly lower, ranging from 31 mg/kg to less than 50 mg/kg in SB4 (5'-6'), SB7 (11.5'-12'), SB8 (19.5'-20') and SB10 (17.5'-18.5'). Total VOC concentrations ranged from 4 mg/kg to less than 10 mg/kg in SB4 (16.5'-17'), SB7 (8'-8.5'), SB8 (7.5'-8.5') and SB10 (7.5'-9'). Total VOCs were detected at concentrations less than or equal to 0.12 mg/kg in SB4 (17'-18'), SB5 (8.5'-9.5'), SB5 (18.5'-20'), SB6 (6'-7'), SB6 (17.5'-18.5'), SB9 (8'-9'), SB9 (17.5'-18') and SB9 (18'-19').

As summarized in Table 2, the highest concentrations of total SVOCs occurred in SB4, (5'-6'), SB7 (8'-8.5') and SB8 (7.5'-8.5'), at 12 mg/kg, 10 mg/kg and 12 mg/kg, respectively. Soil borings samples SB7 (11.5'-12'), SB7 (12.5'-13'), SB9 (8'-9') and SB10 (7.5'-9') had total SVOCs concentrations ranging between 2.7 and 5.4 mg/kg. Total SVOCs were less than or equal to 0.42 mg/kg in SB4 (17'-18'), SB5 (8.5'-9.5'), SB5 (9.5'-10'), SB6 (6'-7'), SB6 (17.5'-18.5'), SB8 (17.5'-18.5') and SB9 (18'-19'). SVOCs were not detected in soil samples SB5 (18.5'-20'), SB8 (19.5'-20') and SB10 (17.5'-18.5').

Horizontal and Vertical Extent. In general, the horizontal extent of chemicals detected in soil has been determined along the southern and western side of the area of investigation. The soil in the area north of Tank Farms #2 and #3 and Container Storage Area #1, and in the central and eastern sections of the area of investigation indicate that volatile and semi-volatile organic compounds are present in the soil. The vertical extent of chemicals detected in soil appears to occur down to approximately twenty feet below grade throughout most of the area of investigation; however, additional confirmatory sampling is proposed in this workplan for the area north of Container Storage Area #1 (see Section 6).

3.3.2 Groundwater Impacts

The results of the Phase I RFI provided preliminary information regarding the occurrence and types of inorganic and organic chemicals detected in groundwater at the CRC, chemical concentrations, and the vertical and horizontal extent of the detected chemicals.

Detected Chemicals and Occurrence. Organic compounds have been detected in groundwater samples collected in the vicinity of Tank Farm #3, south of Tank Farm #2, and along the north and west side of Container Storage Area #1. Low levels of inorganic compounds were detected (at concentrations comparable to naturally occurring levels) in groundwater samples collected from monitoring well MW2. No sulfides, cyanide, PCBs, dioxins or furans were detected in groundwater samples collected from monitoring well MW2. No immiscible fluids were detected with the dual interface probe in any of the site monitoring wells during the three 1993/1994 groundwater sampling events.

Table 3 summarizes the chemicals detected in groundwater samples collected from the site monitoring wells.

Concentrations of Chemicals in Groundwater. The highest chemical concentrations in groundwater were identified in wells in the northern sections of the two SWMU areas (MW2, MW8 and MW10). Wells along the western and southern portions of the area of investigation (MW5, MW9, MW6) had fewer detected chemicals in analyzed groundwater samples and much lower concentrations of the detected chemicals.

The results of the Phase I RFI indicate that the highest concentrations of VOCs were detected in samples from monitoring wells MW2, MW4, MW7, MW8 and MW10: total VOCs were detected at concentrations between 30 and 100 mg/l in MW4, MW7, MW8 and MW10, and at concentrations above 300 mg/l in MW2. Low levels of VOCs were identified in samples from monitoring wells MW1, MW3, MW5, MW6 and MW9: total VOCs detected in MW5 and MW9 are less than 1 mg/l, and total VOCs detected in MW1, MW3 and MW6 range between 1 and 25 mg/l. The maximum total VOC concentration was detected in a sample from monitoring well MW2 in 1991 (412 mg/l) and the lowest total VOC concentration was detected in a sample from monitoring well MW5 in December, 1993 (0.03 mg/l).

Based on the results of the Phase I RFI, the highest concentrations of SVOCs were detected in samples from monitoring wells MW2, MW3, MW4, MW7, MW8 and MW10: total SVOCs were detected consistently at concentrations between 30 and 100 mg/l in MW7 and MW10 and at concentrations above 500 mg/l in MW2, MW3, MW4 and MW8. Non-detectable or low levels of SVOCs were identified in samples from monitoring wells MW5, MW6 and MW9: total SVOCs detected in MW6 and MW9 are less than 1 mg/l, and no SVOCs were detected in MW5. The maximum total SVOC concentration was detected in a sample from monitoring well MW4 (2949 mg/l in February, 1994) and the lowest total SVOC concentration was detected in a sample from monitoring well MW5 (non-detect for both the December, 1993 and February, 1994 sampling events).

Groundwater samples collected in 1994 from monitoring well MW2 were analyzed for seventeen metals (35 IAC 724 Appendix I metals). Of these, five metals were detected at concentrations above reporting limits: up to 0.011 mg/l total arsenic, 0.099 mg/l total barium, 0.026 total chromium, 0.011 total lead and 0.14 total zinc. In townships surrounding the City of Chicago area, these metals occur in groundwater at concentrations of 0.001 to 0.003 mg/l for arsenic, 0.010 to 0.109 mg/l for barium, less than 0.005 to 0.030 mg/l for chromium, less than 0.005 to 0.009 mg/l for lead and less than 0.005 to 0.153 mg/l for zinc (ISGS, personal communication, June 94).

Horizontal and Vertical Extent. In general, the horizontal extent of chemicals detected in groundwater has been determined along the southern and western sides of the area of investigation. Groundwater samples collected from the area north of Tank Farms #2 and #3 and Container Storage Area #1, and in the central and eastern sections of the area of investigation indicate that volatile and semi-volatile organic compounds are present in the groundwater. The vertical extent of chemicals detected in groundwater occurs down to the top of the clay (approximately ten feet below grade throughout most of the area of investigation). Additional groundwater sampling is proposed in this workplan for the areas north and east of Container Storage Area #1 (see Section 6).

3.4 PHYSICOCHEMICAL CHARACTERISTICS OF DETECTED COMPOUNDS

Other information required by the permit for this investigation include a description of the waste or hazardous waste constituent characteristics, such as the type of waste and its physical and chemical properties. Tables 4a and 4b list some of the known physicochemical properties for the VOCs and SVOCs (respectively) detected in soil and groundwater at the CRC. The Phase II RFI will continue to characterize these factors where information is available.

4. POTENTIAL MIGRATION PATHWAYS

Other information required by the permit for this investigation include a description of potential migration pathways. The potential migration pathways for possible impacts identified in the SWMU areas are generally limited to migration through the groundwater and air. No known water supply wells or critical natural habitats presently exist within a 1500 foot radius of the SWMU areas. As discussed above, organic compounds have been detected in samples collected from the shallow groundwater at the site. It appears that the groundwater impacts are limited to the shallow saturated zone which would likely not be suitable as a drinking water source. Therefore, there are no likely immediate threats to human health or the environment through this potential migration route. The hydrogeological information collected during the Phase I RFI preliminarily determined extent and rate of migration through the groundwater. Work elements proposed in the Phase II RFI workplan are designed to supplement information regarding the direction and rate of groundwater flow.

It is also possible that chemicals in the soil and groundwater of the SWMU area could migrate from the SWMU area through air via volatilization or associated with entrained dust particles. However it is expected that this route of migration is relatively minor and will not pose significant threats to human health or the environment. A screening level estimate of the possible impacts of volatilization from the SWMU area was presented in Section 5.2.6 of the May, 1993 Phase I Workplan, and indicated minimal relative impacts via this route.

Other potential exposure routes include ingestion and dermal contact with impacted surficial soil. However, the entire Safety-Kleen CRC is secured by a perimeter fence, preventing access by non authorized employees. Therefore, the potentially exposed population is limited to Safety-Kleen personnel. It is likely that exposure to the impacted soil through ingestion and direct contact is minimal.

5. ADMINISTRATIVE OUTLINE AND PROJECT MANAGEMENT PLAN

The following sections summarize the objectives, the technical tasks and project management plan, including management approach and personnel, for the proposed Phase II RFI.

5.1 OBJECTIVES

According to the permit requirements and IEPA's September 30, 1994 response to the Phase I RFI Report, the objective of the Phase II RFI is to determine the horizontal and vertical extent of impacted soil and groundwater around each of the SWMUs of concern. The Phase I RFI included elements of a Phase II RFI; therefore, preliminary information has been obtained regarding the types and concentrations of chemicals in soil and groundwater at the SWMU areas, the extent and distribution of impacts in soil and groundwater at the SWMU areas, and site geology and hydrogeology (including the direction and rate of groundwater flow). This information is summarized in Section 3 of this workplan and presented in detail in the June 30, 1994 Phase I RFI Report. Safety-Kleen proposes to collect additional information to supplement and confirm these preliminary findings. The following sections summarize the additional proposed Phase II RFI activities, which include additional soil and groundwater sampling for further extent and distribution characterization.

5.2 TECHNICAL TASK OUTLINE

The proposed technical tasks outlined herein and described in detail in Section 6 of this workplan are designed to provide additional information regarding the vertical and horizontal extent of impacts in soil and groundwater. Specifically, an investigation using a Geoprobe sampling device is proposed to supplement and confirm information regarding the extent and distribution of soil and groundwater impacts. Groundwater samples would be collected and analyzed onsite with a portable gas chromatograph (GC) to provide immediate quantitative screening information on groundwater quality. Groundwater samples also will be collected for laboratory analysis. Soil samples for extent and distribution characterizations also would be collected and sent to a laboratory for analysis. Based on the results of this investigation, confirmatory soil samples and additional monitoring wells (if necessary) would be proposed. Confirmatory soil samples would be collected from the proposed soil borings for laboratory analysis, and groundwater samples and static water level data would be collected from additional monitoring wells, if necessary. Two existing piezometers would be converted to clusters to determine the

possible influence of vertical groundwater gradients in the shallow saturated zone in the vicinity of the perimeter of the demolished Tank Farm #3 dike. Finally, laboratory permeability testing in samples from the saturated clayey silt/silty clay zone is proposed to provide additional information related to the rate of groundwater flow at the site.

The specific sampling, laboratory, and quality assurance procedures that will be employed are presented in the Quality Assurance Project Plan (QAPP) submitted with the May, 1993 Phase I RFI Workplan (as approved with modifications by IEPA in their September 23, 1993 response letter). The QAPP is presented as an attachment to the Phase I Workplan. Exerpts from the September 23, 1993 IEPA qualified approval letter (containing specific guidance for soil and groundwater sampling and decontamination procedures) are included in Attachments B, D and E of this document. Data management and record keeping procedures were presented in the Data Management Plan submitted as an attachment to the May, 1993 Phase I RFI Workplan. All onsite work will be performed diligently and safely in accordance with the Health and Safety Plan (HASP) submitted with the May, 1993 Phase I Workplan.

As stated in Attachment G of the permit, the schedule for the Phase II RFI activities will be negotiated with IEPA during review of this workplan; however, a tentative schedule is presented in Section 7 of this document. Formal bids will be solicited from the subcontractors after the workplan is approved. Upon project completion, the Phase II RFI report will be submitted to IEPA for review as required by the permit. In addition to the Phase II report, quarterly progress reports will be submitted to the IEPA according to the schedule in Attachment G of the permit.

5.3 PROJECT MANAGEMENT PLAN

This section outlines the project management approach for the Phase II RFI and identifies the personnel that will be available to assist the project activities.

5.3.1 Management Approach and Project Personnel

The Phase II RFI workplan will be conducted on behalf of Safety-Kleen Corp. by LTI, Limno-Tech, Inc. (LTI) of Ann Arbor, MI. LTI will oversee, manage, and conduct the technical aspects of the RFI. The analytical laboratory services for this project will be provided by Industrial and Environmental Analysis (IEA) in Schaumburg, Illinois or by Safety-Kleen Technical Center in Elk Grove Village, Illinois or other qualified laboratory. When the Workplan is approved, bids will be solicited from qualified drilling contractors for this project. Environmental Drilling and Contracting of Holland, MI, and Mateco Drilling Company of Grand Rapids, Michigan will be included on the driller bidding list.

LTI will perform the field investigations; compile, review, and evaluate the RFI data; provide QA/QC review and oversight; and prepare the RFI report. The roles and responsibilities of the LTI personnel that will work on this project are listed below and are discussed (with a summary of staff qualification) in the QAPP (see May, 1993 Phase I Workplan). Complete resumes for all project staff are on file and available upon request.

ROLE	PERSONNEL	GENERAL RESPONSIBILITIES
Project Administrator	Paul I. Freedman	<i>General Oversight</i>
Project Manager	Greg W. Peterson	<i>Project Management Review/approval of all work products; Direct all field, quality assurance, data evaluation and reporting activities.</i>
Project Engineer/Scientist	Joyce Dunkin Robert J. Belz Scott B. Bell Cathy A. Whiting	<i>Supervise all field sampling, quality assurance, data evaluation and reporting activities.</i>
Assistant Project Engineer/Scientist	Jonathan B. Farr Jing Chen John T. Peterson Brian D. Lord	<i>Field and technical support</i>

The qualifications of IEA and their personnel are provided in Attachment A. The project and quality assurance managers for this project at IEA will be Jim Dowse and Tom Bauer, respectively.

6. WORK PLAN INVESTIGATION ELEMENTS

This section outlines the technical tasks for the proposed Phase II RFI and contains a proposal for groundwater classification in accordance with 35 IAC Part 620, as requested in the IEPA September 30, 1994 response to the Phase I RFI Report. The technical tasks presented in this proposal are consistent with Section 7.2 of the Phase I Report, as requested in IEPA's September 30, 1994 response to the Phase I RFI Report.

The permit requires that sampling plans include groundwater, soil, sediment, surface water, and air sampling. For the CRC SWMU areas, only groundwater and soil sampling is proposed. There are no sediments or surface waters in the vicinity of the SWMU area and therefore these requirements are not applicable. In addition, as discussed in Section 4, releases to air from the SWMU area are estimated to be negligible, therefore, no air monitoring programs are proposed, other than the air monitoring that will occur as part of the health and safety plan. The proposed Phase II RFI workplan tasks are discussed in detail in the following sections. The detailed procedures that will be employed during implementation of these tasks are presented in the QAPP (see the May, 1993 Phase I RFI Workplan as modified by the September 30, 1993 IEPA qualified approval letter).

6.1 TECHNICAL TASKS

The objectives of the Phase II RFI are to expeditiously and cost effectively determine the horizontal and vertical extent of constituents in soil and groundwater at the Safety-Kleen. Specifically, the additional information would be collected in a two-part approach:

- The first part would consist of an investigation with a Geoprobe device to provide additional information on the extent and distribution of soil and groundwater impacts; and,
- The second part of the investigation would consist of confirmatory soil and groundwater sampling (if necessary) and laboratory analysis once the vertical and horizontal limits of site impacts have been determined from the geoprobe results.

A geoprobe and a field GC are an effective combination of tools to rapidly acquire extensive and fairly reliable VOC screening data for groundwater. The use of an onsite GC for groundwater field screening during the first part of the Phase II RFI would provide quantitative groundwater screening data throughout the CRC within a few days and would allow for focused confirmatory laboratory sampling.

The Phase II RFI technical tasks described in this section include:

- A soil and groundwater sampling plan using a Geoprobe sampling device, a field GC and laboratory analyses to determine vertical and horizontal extent and distribution of impacts;
- The installation of additional soil borings and monitoring wells (if necessary) to collect confirmatory soil samples and monitor groundwater quality;
- The installation of shallow piezometers to monitor vertical groundwater gradients in the vicinity of Tank Farm #3;
- Soil testing for additional hydraulic conductivity determinations in the clayey silt/silty clay zone; and
- A groundwater monitoring program to collect static water level on a quarterly basis for one year.

A technical memorandum summarizing the results of the preliminary soil and groundwater investigations proposed in Sections 6.1.1 and 6.1.4 and additional proposed sampling locations (if necessary) and a proposed list of analytes will be submitted to IEPA within approximately 90 days of the completion of the preliminary field activities. Additional investigations (if necessary and as proposed in Sections 6.1.2 and 6.1.3) will proceed upon approval by IEPA. If additional groundwater sampling is necessary, it would be conducted in accordance with the procedures presented in Section 6.1.5.

6.1.1 Investigation to Determine Extent and Distribution of Soil and Groundwater Impacts

Soil and groundwater samples will be collected with a Geoprobe device (a hammer-driven hydraulic probe) to further characterize the extent and distribution of impacts along the eastern and northern sides of the area of investigation. The sampling method employed will be consistent with the American Society of Testing and Materials (ASTM) Method D1587 - Thin-walled Tube Sampling of Soils. Relatively undisturbed samples will be collected using the Geoprobe sampling tools, which are similar to Shelby Tube samplers.

The eight initial proposed sampling locations are depicted in Figure 7. Six of the eight initial proposed locations are spaced approximately 100 feet apart along the eastern and northern sides of Container Storage Area #1. The other two initial proposed geoprobe locations are situated at the southern end of the alley and north of monitoring well MW4. It is proposed that additional locations would be sampled with the Geoprobe further to the north and east depending on the groundwater screening results obtained with the field GC.

For example, if the groundwater screening results for boring location GP4 indicate that constituents remain in groundwater, then a groundwater sample from an additional boring location approximately 100 feet away (east) would be collected for field screening with the portable GC. The area of investigation will not extend beyond the Ashland Cold Storage building to the west, 42nd Street to the north, the railroad tracks to the east and West 43rd Street to the south.

One groundwater sample and two soil samples will be collected from each of the initial proposed geoprobe locations. Groundwater samples will be analyzed onsite for VOCs with a portable gas chromatograph (GC) to provide immediate screening information regarding the extent and distribution of groundwater impacts. The number and location of the borings may vary based on the groundwater screening results. Selected groundwater samples would be submitted for confirmatory analyses at a laboratory for VOCs and SVOCs. All soil samples collected with the Geoprobe device will be submitted for laboratory analyses. No field screening of soil samples will be performed.

Methods of Sample Analysis. Groundwater samples collected for field screening will be analyzed for the parameters listed in Table 5. Groundwater samples collected for laboratory analyses will be analyzed for the list of organic analytes and practical quantitation limits (PQLs) summarized in Table 6. Groundwater analyses at the laboratory will follow SW846 Methods 8240 for VOCs and 8270 for SVOCs. The PQLs listed in Table 6 will be achieved when possible; however, it is possible that matrix interferences and dilutions may necessitate higher reporting limits.

IEPA's September 30, 1994 response to the Phase I RFI Report stated that no further inorganic analysis is necessary in the soil at the CRC. In addition, IEPA's September 30, 1994 response to the Phase I RFI Report requested that the Phase II RFI include specific analyses for VOCs and polynuclear aromatic compounds (PNAs) for any soil samples intended to demonstrate the boundary of impacts. These analytes and preliminary target levels requested by IEPA are summarized in Table 7. Soils analyses at the laboratory will follow SW846 Methods 8240 for VOCs and 8270 or 8310 for SVOCs.

The preliminary soil target levels listed in Table 7 will serve as criteria for determining the extent of soil sampling/analysis necessary during the RFI, as stated by IEPA in their September 30, 1994 response to the Phase I RFI Report. Final cleanup objectives to determine the need for and extent of soil remediation will be established after the RFI is complete. The laboratory analyses listed above will be conducted in accordance with the procedures presented in the QAPP for IEA (see Attachment A).

Sampling Method. Soil and groundwater samples will be collected from the eight initial proposed geoprobe locations depicted in Figure 7. A shallow vadose zone soil sample will be collected from approximately 0 to 4 feet below grade with a 4-foot long Shelby tube-type sampling device equipped with a clear liner tube. In addition, the boring will be

advanced to approximately 2 feet into the clay (approximately 12 to 15 feet below grade) and a clay sample will be collected with a 2-feet long shelly tube-type sampling device. In accordance with IEPA sampling methods (see Attachment B), both the vadose zone and clay soil samples will be collected by cutting out a portion of the clear liner and capping the ends of the removed sample section. The samples will be labeled and stored in a chilled cooler. All soil samples will be submitted to IEA or Safety Kleen Technical Center for the VOC and SVOC laboratory analyses summarized in Table 7. Soil samples will be extracted from the liner sections at the laboratory by laboratory personnel.

In addition, at each geoprobe sampling location depicted in Figure 7, one groundwater sample will be collected from the water table using a peristaltic pump with disposable polyethylene tubing. The groundwater sample will be split into separate sampling containers (40-ml vials and liter amber glass jars). One 40-ml vial will be analyzed onsite for VOCs with the field GC. The additional sample volume will be stored in a chilled cooler. Based on the field GC results, selected samples will be sent to IEA or Safety Kleen Technical Center for confirmatory VOC analyses. All of the 1 liter amber jar samples will be sent to the laboratory for analysis of SVOCs.

6.1.2 Installation of Additional Soil Borings/Monitoring Wells

If necessary, based on the results of the soil and groundwater investigations with the Geoprobe device, additional soil borings and monitoring wells will be proposed. The proposed soil boring locations would be selected to provide confirmatory soil quality data where necessary. The proposed wells would provide data to better define groundwater flow directions and confirm the horizontal extent of groundwater impacts at the site, where necessary. The locations of the borings/wells would be selected to supplement the gaps in the existing groundwater data set, and to provide information along the northern and eastern boundaries of the area of investigation. Any proposed soil boring/monitoring well locations will be subject to approval by the IEPA, after the IEPA has reviewed the results of the preliminary soil and groundwater investigations. The methods that would be used will be consistent with the following:

Drilling Method. If additional soil borings are necessary, they will be advanced (wherever feasible) using the hollow-stem auger drilling method. The hollow-stem augers will be equipped with O-rings to minimize the introduction of groundwater into the borehole, and to maintain the representativeness of samples collected from the boring. In situations where physical features limit the access of drill rigs, borings will be completed with either a hand-driven or a portable power-driven split-spoon sampler, depending upon required depth and material. Use of any other alternate drilling method (e.g., driven casing, mud rotary, air rotary, cable tool, etc.) for this project will be subject to approval by the IEPA.

Soil Boring Sampling Methods. If any soil borings/monitoring wells are installed, continuous split spoon sampling would be conducted to characterize the lithology and to collect samples for confirmatory laboratory analysis. Discrete soil samples would be collected in accordance with ASTM D1586 for split-spoon sampling or ASTM D1587 for thin-walled tube sampling and consistent with IEP A soil volatile sampling procedures (see Attachment B). Any soil samples collected for laboratory analysis would be shipped in accordance with the procedures in the QAPP for analysis of the parameters listed in Table 7. Only discrete soil samples would be collected; no compositing of samples will be performed.

Soil samples collected from the unsaturated zone and clay interval would be used for physical characterization and laboratory analyses, and soil samples collected from the saturated zone would be used for physical characterization, as follows:

- **Soil Samples from the Unsaturated Zone.** Two discrete soil samples would be collected for laboratory analysis from the unsaturated interval in each borehole (located above approximately 3 to 5 feet below grade). The soil samples would be collected continuously ahead of the hollow-stem augers using split spoon samplers fitted with four 6-inch brass liner sampling tubes. Immediately upon opening the split spoon sampler, one of the six inch tubes would be removed and prepared for shipment. If necessary, bentonite would be added to the ends of the sample to minimize headspace. The ends of the sample tube would be covered with aluminum foil and capped, or sealed with packing tape. The sample tube would be labeled and stored in a chilled cooler.

After the sample is sealed and stored, the soil inside other brass tubes in the sampler would be extracted from the brass tubes for visual characterization according to the Unified Soil Classification System (USCS). Soil boring logs would be maintained for each boring and include the soil classification, standard penetration blow counts, depth to water table, and other physical characteristics.

- **Soil Samples from Saturated Interval.** Soil samples would be collected continuously from the saturated interval for physical characterization only using two-foot long split spoon samplers. The saturated interval is present at the site between approximately 10 to 13 feet below grade and above the clay layer. No brass liners would be used to collect the saturated soil samples. No soil samples would be collected from the saturated interval for laboratory analysis.

- **Soil Samples from the Clay Zone Below the Saturated Interval.** Upon reaching the top of the clay interval, the hollow stem augers would be advanced approximately two feet into the clay. The two-foot long split spoon sampler fitted with four 6-inch brass liners would be advanced ahead of the auger bit into the clay to collect one clay sample for laboratory analysis. Immediately upon opening the split spoon sampler, one of the 6-inch brass liner tubes would be removed and prepared for shipment. If necessary, bentonite will be added to the ends of the sample to minimize headspace. The sample tube will be covered with aluminum foil and capped, or sealed with packing tape. The sample tube would be labeled and stored in a chilled cooler.

After the clay sample has been sealed and stored, the clay soil inside other brass tubes in the sampler would be extracted from the brass tubes. The soil would be visually classified according to the Unified Soil Classification System (USCS). The borehole would be backfilled with bentonite chips up to the top of the clay interval if a monitoring well would be installed in the saturated interval, otherwise the soil boring would be backfilled completely with bentonite chips.

Monitoring Well Installation. If additional monitoring wells are necessary, based on the results of the preliminary groundwater investigation (described in Section 6.1.1), they would be installed to a depth just above the clay layer (approximately ten feet below grade) as allowed by subsurface conditions, with the riser and protective casing extending above ground surface. Preferentially, all wells would be constructed in this manner, however, if the above-ground riser would be an obstruction to traffic or would otherwise create a hazard, the wells would be finished with flush-mounted protective casings.

The monitoring wells would be installed in the borehole by placing the screen and casing assembly with bottom plug through the hollow-stem augers. The well construction materials would be new, clean, and of sound condition. Wells would be constructed of 2 inch diameter, 5-foot long, 0.007 inch PVC screen with 2 inch diameter PVC risers. PVC material will be used instead of stainless steel to minimize costs and because the results of the Phase I investigations indicate that the concentrations of chlorinated compounds in soil and groundwater at the CRC will not compromise the integrity of PVC materials. A washed silica sand filter pack (#7 sand) would be placed in the annular space surrounding and to at least two feet above the screen. If the soil characteristics indicate that a sand filter pack is not necessary, the auger string would be pulled back to allow the natural aquifer material to collapse around and to at least two feet above the screen. Bentonite chips would be placed in the annular space above the filter pack to the surface to provide a seal. The sand pack and bentonite seal would be sounded during installation using a weighted measuring tape to insure that adequate amounts of the material are added.

A protective steel casing (either flush mount or above grade, dependent upon site requirements) would be installed over the well riser and cemented into place so that the cement extends approximately one foot away from the casing and is sloped to allow water to drain away from the well. The protective steel casing either would be lockable or a locking cap would be placed in the top of the well riser pipe.

The top of the well riser would be marked for use collecting groundwater elevation measurements. The elevation of the marked point on the well riser, the ground elevation and the well location would then be surveyed to an existing benchmark using standard instruments and survey techniques.

Monitoring well construction logs would be recorded for each well according to the IIEPA Well Construction Report format (see Attachment C). The information in this format includes screen and riser materials, filter pack and annular seal materials, well dimensions, and casing and screen elevations.

All wells would be developed, after installation, to remove fine-grained materials according to procedures described in the QAPP. Development methods would include surging, overpumping, and bailing techniques. Development would continue until turbidity, temperature, conductivity and pH measurements from sequential samples stabilize. All development water would be collected, containerized, and stored onsite until arrangements are made for proper disposal.

Decontamination Methods/Health and Safety Sampling devices will be decontaminated in accordance with IIEPA standards for soil sampling (see Attachment B). Drilling augers will be power-washed using high pressure hot water or steam between each borehole. Appropriate personal protective equipment will be worn by all personnel in accordance with the Health and Safety Plan (HASP).

6.1.3 Installation of Clustered Piezometers in Vicinity of Tank Farm #3

Two additional piezometers will be installed as clusters to existing piezometers P1 and P2 to determine the presence of vertical groundwater gradients, if any, in the vicinity of Tank Farm #3. Existing piezometers P1 and P2 are constructed of 3-foot long screens that straddle the water table. The additional piezometers (P1A and P2A) will be installed deeper in the saturated interval to just above the top of the clay, at approximately 12 feet below grade in the vicinity of P1 and approximately 8 feet below grade in the vicinity of P2. The P1 cluster will provide vertical gradients information inside the remains of the Tank Farm #3 dike, and the P2 cluster will provide vertical gradient information immediately outside the dike remains.

The additional piezometers will be constructed of 1-foot long stainless steel 0.007 inch PVC screens with PVC riser pipe. The piezometers will be installed with a drill rig using the hollow stem auger method, as described in Section 6.1.2. Soil samples will be collected continuously every two feet with a split spoon sampler for physical characterization. The boring will be terminated when the top of the clay is encountered. After the piezometers are placed in the borehole, the hollow stem augers will be extracted to allow natural collapse of the borehole. The upper two feet of the borehole will be sealed with cement to stabilize the riser pipe. The piezometers will be finished above grade with no protective casing, similar to the construction of existing piezometers P1 and P2.

The top of the piezometer risers will be marked for use in collecting groundwater elevation measurements. The elevation of the marked points on the piezometer risers, the ground elevations and the piezometer locations will be surveyed to an existing benchmark using standard instruments and survey techniques.

6.1.4 Permeability Testing of Clayey Silt/Silty Clay Zone

The Phase I RFI Report stated that a one-day pumping test would be proposed as part of the Phase II activities to determine the feasibility of long-term pumping in the shallow saturated zone. The October 4, 1994 short term pumping tests in MW8 and MW10 indicated the saturated interval responds poorly to stress and that longer term pumping tests probably are not feasible at the site using the existing wells. Alternatively, laboratory permeability testing of the saturated interval is proposed to supplement the existing hydraulic conductivity data. These data will be used to assist evaluations for interim corrective actions, if necessary.

During the installation of one of the soil borings described in Section 6.1.1, a soil sample will be collected from the saturated interval for permeability testing. The sample will be collected with a Geoprobe sampling device equipped with a 2-foot long shelly tube-type sampling device and a brass liner. The brass liner will be extracted from the split spoon, capped and labeled and sent to Professional Services Industries, Inc. (PSI) in Ann Arbor, Michigan or another qualified laboratory for permeability testing. The results from this test will be compared to the hydraulic conductivity results obtained from the February, 1994 slug tests.

6.1.5 Groundwater Monitoring

After all new necessary monitoring wells have been installed, the new and existing monitoring wells will be monitored for static water level data quarterly for one year according to procedures described in the QAPP. All new piezometers and necessary

monitoring wells will be surveyed relative to existing site wells. If additional groundwater sampling for water quality data is necessary, it will be conducted in accordance with the purging, sampling and decontamination procedures presented in this section.

Static Water Level Measurements. After water levels have been allowed to equilibrate in the wells for at least 1 hour after removal of an unvented well cap, the groundwater static level will be measured from the top of the well casing to the top of the water surface and recorded as a portion of the well sample data. Electronic water level indicators or a chalked steel measuring tape may be used to collect the static level data. The static water level data will be evaluated to supplement existing data regarding groundwater flow direction. If groundwater sampling is necessary, static water level data would be collected prior to purging and sampling the well.

Monitoring Well Purging. All purge water would be collected, containerized and stored onsite until arrangements are made for proper disposal. During purging, pH, temperature and conductivity would be measured and recorded at regular intervals. In general, purging would be continued until these parameters have stabilized over a period of at least ten minutes or after a minimum of three well volumes have been removed from the well. Because some of the existing monitoring wells recharge very slowly, these wells and any other slowly recharging wells would be sampled after they have been bailed dry once and allowed to recover.

Groundwater Sampling. Groundwater samples would be collected from monitoring wells using either a low flow pump (e.g. bladder pump), a clean Teflon bailer or a new disposable polyethylene bailer. Groundwater samples would be collected according to the procedures recommended by IIEPA in their September 23, 1993 response to the Phase I Workplan (see Attachment D). The groundwater samples would be submitted to IEA or Safety-Kleen Technical Center for laboratory analysis.

Decontamination Methods/Health and Safety. Sampling devices would be decontaminated in accordance with the November, 1992 RCRA Groundwater Monitoring Draft Technical Guidance (EPA/530-R-93-001, see Attachment E). Appropriate personal protective equipment will be worn by all personnel in accordance with the Health and Safety Plan (HASP).

6.2 PROPOSAL FOR GROUNDWATER CLASSIFICATION

As requested in IIEPA's September 30, 1994 response to the Phase I RFI Report, this section contains a proposal for groundwater classification at the CRC in accordance with 35 IAC Part 620. The Water Quality Standards adopted in November, 1991 as 35 IAC Part 620, contains Subpart B, under which all groundwaters of the state of Illinois are designated as:

- a) One of the following four classes of groundwater in accordance with Sections 620.210 through 620.240:
- | | |
|---------------|-------------------------------|
| 1) Class I: | Potable Resource Groundwater; |
| 2) Class II: | General Resource Groundwater; |
| 3) Class III: | Special Resource Groundwater; |
| 4) Class IV: | Other Groundwater; or |

- b) A groundwater management zone in accordance with Section 620.250.

General Resource Groundwater (Class II) is groundwater which:

- Does not meet the provisions of Class I, Class III or Class IV groundwater classifications; or
- Is found by the Illinois Pollution Control Board (pursuant to the petition procedures set forth in Section 620.260) to be capable of agricultural, industrial, recreational or other beneficial uses.

Using the criteria presented in Appendix D to the September 30, 1994 response (Guidance for Demonstrating Groundwater is Class II Groundwater, see Attachment F), groundwater at the CRC generally does not meet the provisions of Class I, Class III or Class IV groundwater designations. Although the criteria for a Class II designation are fairly strict, Safety-Kleen proposes that the appropriate groundwater classification which should be applied to groundwater encountered at the CRC is Class II.

6.2.1 Summary of IEPA Guidance for Demonstrating Groundwater is Class II Groundwater

The document presented in Attachment F outlines the information which should be compiled and submitted to IEPA to demonstrate that a given groundwater is Class II groundwater. This information includes:

1. Background information regarding the facility's operations;
2. A scaled drawing showing the location of the facility;
3. The discussion of the reason why it is necessary to classify the groundwater of concern at the facility;
4. A description of any remedial actions being carried out at the facility;
5. The results of the review of existing general information regarding the geology/hydrogeology of the facility and surrounding area as discussed above;

6. A description of onsite geology and hydrogeology, including a description of the groundwater which is being classified and the geologic formation in which the groundwater is located. This description should be in accordance with the guidance set forth in the TEGD;
7. Information indicating that the groundwater of concern is not a Class III groundwater (see 35 IAC 620.230) or a Class IV groundwater;
8. Information, as appropriate, indicating that the groundwater has already been determined to be Class II groundwater by the Illinois Pollution Control Board as allowed by 35 IAC 620.260;
9. Information indicating that the groundwater is less than 10 feet below the groundwater surface. If a continuous zone containing groundwater begins within 10 feet of the ground surface and extends greater than ten feet below the ground surface it will not be considered a Class II groundwater if an additional criteria is met under 620.210; in this case it would be considered Class I groundwater...or,
10. Information demonstrating that the groundwater is not Class I groundwater as defined in 35 IAC 620.210. This demonstration can be made by addressing the following, as summarized in the flowchart in Attachment F:
 - Location of the groundwater relative to the minimum setback of a well and use of the geologic material as a potable resource;
 - Characteristics of the onsite geology of the saturated zone (unconsolidated or consolidated);
 - Ability of the geologic material to sustain a yield of at least 150 gallons per day from a thickness of 15 feet or less; and
 - Hydraulic conductivity of the geologic material.

6.2.2 Proposal For Class II Designation of Groundwater at the CRC

This section summarizes the information which has been compiled to demonstrate that the CRC groundwater is Class II groundwater. Each of the 10 required information categories listed in Section 6.2.1 is addressed in this section as follows:

1. Background information regarding the facility's operations has been provided to IEPA in the March, 1990 RCRA Facility Assessment, the September 30, 1992 RCRA Part B Permit, the May, 1993 Phase I RFI Workplan, the June, 1994 Phase I RFI Report and as summarized in Section 2 of this document.
2. A scaled drawing showing the location of the facility has been provided to IEPA in the March, 1990 RCRA Facility Assessment, the September 30, 1992 RCRA Part B Permit, the May, 1993 Phase I RFI Workplan, the June, 1994 Phase I RFI Report and Figures 1 and 2 of this document.
3. It is necessary to classify the groundwater of concern at the facility because the Illinois Pollution Control Board adopted the Groundwater Quality Standards in 35 IAC Code 620 in November 1991 for purposes of determining the appropriate quality standards which groundwater in the State of Illinois should meet. Unless site-specific information demonstrates otherwise, the Bureau of Land presumes that all groundwater beneath a facility must meet the most stringent quality standards (Class I) in 35 IAC 620. Safety-Kleen was requested to classify the groundwater at the CRC in IEPA's September 30, 1994 response to the Phase I RFI Report.
4. No remedial actions for soils or groundwater are being carried out at the facility.
5. A review of existing general information regarding the geology/hydrogeology of the facility and surrounding area has been provided to IEPA in the March, 1990 RCRA Facility Assessment, the January 27, 1994 First Quarterly Report, the June, 1994 Phase I RFI Report and as summarized in Section 3 of this document.
6. A description of onsite geology and hydrogeology, including a description of the groundwater which is being classified and the geologic formation in which the groundwater is located, has been provided to IEPA in the (1) 1991 Supplemental Investigation Report; (2) the June, 1994 Phase I RFI Report; and (3) as summarized in Section 3 of this document.
7. The available information (as summarized in the March, 1990 RCRA Facility Assessment, the January 27, 1994 First Quarterly Report, the May, 1993 Phase I RFI Workplan, the June, 1994 Phase I RFI Report and Section 3 of this document) indicates that the groundwater of concern is not a Class III groundwater (see 35 IAC 620.230) or a Class IV groundwater: the CRC is located in an urban commercial/industrial area; no significant surface features such as lakes, ponds, wetlands, streams depressions or other features which would affect the migration routes of potentially released materials exist within

a 1500 feet radius of the facility; according to the RCRA Facility Assessment the CRC is not located within any 100 year floodplain; and the nearest surface water to the facility is the South Branch of the Chicago River, located approximately 1.5 miles to the north. The information indicates that the groundwater at the CRC does not take on an ecologically vital role as stipulated for Class III groundwater. The information also indicates that the groundwater is not naturally saline, does not occur in the zone of attenuation surrounding a landfill and is not located in a mining-disturbed area, as stipulated for Class IV groundwater.

8. Safety-Kleen has no knowledge indicating that the groundwater already has been determined to be Class II groundwater by the Illinois Pollution Control Board (as allowed by 35 IAC 620.260").

9. The depth of the base of the saturated interval generally is less than 10 feet below grade. According to the groundwater classification criteria provided by IEPA, Class II groundwater is defined by the portion of geologic material containing groundwater located less than 10 feet below the ground surface. As summarized in Section 3.2 and depicted in Figure 8, the base of the shallow saturated clayey silt/silty clay zone is defined by a thick clay unit which occurs at approximately ten feet below grade throughout most of the site. Although the top of the clay is as deep as 13 feet below grade in the vicinity of monitoring wells MW8 and MW10, the transition from clayey silt to clay is gradational. Generally, 2 to 5 feet of silty clay is present above the top of clay as defined in Figure 8. Therefore, the geologic and hydrogeologic data indicate that the majority of the saturated interval occurs less than 10 feet below grade. At most only a few feet of saturated interval occurs below 10 feet in portions of the site, but this material is comprised of silty clay and is underlain by an extensive and thick clay unit.

10. Hydrogeological information from the Phase I investigations demonstrates that the groundwater is not Class I groundwater as defined in 35 IAC 620.210. This information indicates that the CRC groundwaters can be designated as Class II based on the depth of the groundwater alone (the "10 Rule") as presented in Item 9 above. Additional support for this classification is available based on the known use of the CRC groundwaters, the geology of the saturated interval as defined by onsite soil boring logs, the generally poor ability of the saturated interval to support a sustained yield, and the low estimates of the hydraulic conductivity of the saturated interval and underlying clay unit.

- **CRC Groundwaters Not Considered a Well Documented Potable Resource.** As presented in Section 3.2, the shallow saturated zone is not used as an aquifer at the site, and no water withdrawal wells are known to exist within 1500 feet of the CRC. The City of Chicago obtains its potable water from Lake Michigan (ISGS, 1984). Water wells exist in the city, but are used mainly for process and cooling water for industry. Regional bedrock aquifers underlie the lower clay unit; however, there is no evidence that chemicals resulting from site releases are present in the bedrock aquifers or are likely to migrate to deeper saturated zones. There is poor likelihood of hydraulic communication between the shallow saturated interval and deeper aquifers. The geologic information obtained from deep boring MW5D and regional bedrock monitoring wells indicates that the base of the saturated interval is underlain by an extensive and thick, stiff to very hard clay unit (at least 40 feet thick in the vicinity of SB5D). The result of the laboratory permeability test conducted on the clay sample collected from soil boring SB10 indicates an average hydraulic conductivity value of 2.4×10^{-8} cm/sec in the clay interval from 14.5 to 15 feet below grade at SB10/MW10. The clay likely serves as a barrier to the downward migration of impacted shallow groundwater.

- **Onsite Geology of the Saturated Interval Characterized as Clayey Silt/Silty Clay.** As summarized in Section 3.2, the hydrogeologic information obtained from onsite soil borings indicates that the saturated interval consists of unconsolidated glacial deposits comprised of clayey silt/silty clay with an average saturated thickness of 5 to 6 feet. This type of soil does not meet the criteria for Class I designation, which requires unconsolidated geologic material in the saturated zone to consist of sand, gravel or sand and gravel with a thickness of at least 5 feet and with no more than 12% fines. Multiple representative samples obtained from the geologic material beneath the facility fail to meet the criteria of 12% or less fines, as required by the guidance. The soil boring logs from six locations are provided in the June, 1994 Phase I RFI Report.

- **Poor Ability of the Saturated Interval to Support a Sustained Yield.** Information obtained from monitoring well development and purging prior to sampling and from the October 4, 1994 short term pumping tests in MW8 and MW10 indicate that the saturated interval at the CRC has a poor ability to support a sustained yield. This information is summarized in Section 3.2.

- **Hydraulic Conductivity of the Site Soils Is Low.** The results of the in-situ hydraulic conductivity tests indicate local hydraulic conductivity values in the range of 2.67×10^{-4} to 2.97×10^{-4} cm/sec in the vicinity of MW9, 4.26×10^{-4} to 8.16×10^{-4} cm/sec in the vicinity of MW8 (Container Storage Area #1); and approximately 2.46×10^{-5} in the vicinity of MW2 (Tank Farm #3). These values are representative of the clayey silts/silty clays above approximately 10 feet below grade. Below 10 feet, the hydraulic conductivity of the underlying clay unit is 2.4×10^{-8} cm/sec, based on laboratory permeability testing.

7. SUBMISSION OF REPORTS AND RESULTS OF RFI ACTIVITIES AND PROPOSED SCHEDULE

In accordance with the requirements of the permit, a final Phase II RFI report will be prepared and submitted to IEPA according to the proposed schedule presented below. Details of the proposed schedule will be negotiated with IEPA during review of the Workplan, as stipulated in the Permit. Quarterly progress reports will be prepared and submitted on the dates specified in the project schedule. The quarterly reports will contain at a minimum:

- An estimate of the percentage of the investigation completed;
- Summary of activities completed during the reporting period;
- Summaries of all actual or proposed changes to the Workplan or its implementation;
- Summaries of all actual or potential problems encountered during the reporting period;
- Proposal for correcting any problems;
- Projected work for the next reporting period; and
- Other information or data as requested in writing by IEPA.

The Phase II report will summarize the investigation tasks, deviations from specified procedures (if any), all data collected, the quality assurance review, data evaluations, and findings of the Phase II RFI. The Phase II report and laboratory analyses will be certified by personnel in accordance with 35 IAC 702.126 (see Attachment G).

The following schedule is proposed for the activities presented in this workplan:

PHASE II RFI ACTIVITY	DATE
Initial geoprobe sampling (extent and distribution determinations)	Begin within 30 days of IEPA approval to Workplan
Preparation of Tech Memo Summarizing Results of Geoprobe Investigation and Proposed Soil Boring/Monitoring Well Locations (if necessary) and List of Groundwater Analytes	Submit to IEPA 60 days after laboratory data is received
IEPA Review of Data and Proposed Location(s) for Additional Soil Borings/Monitoring Wells (if necessary)	Within 90 days after IEPA receives Tech Memo
Install Piezometers and Additional Soil Borings/Monitoring Wells (if necessary)	Within 60 days after IEPA approval to proceed
Quarterly Static Water Level Monitoring for One Year	Within 45 days after well/ piezometer installation
Phase II Report	Six months after wells/ piezometers installed

8. REFERENCES

- IEPA, RCRA Facility Assessment, Safety-Kleen Chicago Recycle Center, USEPA ILD No. 005450697, IEPA ID. No. 0316000053, March, 1990.
- Canonie, Safety-Kleen Corporation Chicago Recycle Center Supplemental Investigation Report, 1991.
- IEPA, RCRA Hazardous Waste Management Part B Permit for the Safety-Kleen Chicago Recycle Center, USEPA ILD No. 005450697, Permit Log No. 121, September 30, 1992.
- USEPA, RCRA Groundwater Monitoring DRAFT Technical Guidance, EPA/530-R-93-001, November, 1992.
- LTI, RCRA Facility Investigation Phase I Workplan, May 3, 1993.
- IEPA Approval Letter to the Phase I RFI Workplan (qualified), September 23, 1993.
- LTI, Literature Review/Use of the Bower and Rice, Slug Test Method for Field Determination, of Hydraulic Conductivity at the Safety-Kleen CRC (LTI letter to Lawrence Eastep), October 18, 1993.
- LTI, First Quarterly Report for the Safety-Kleen Chicago Recycle Center, January 25, 1994.
- LTI, Second Quarterly Report for the Safety-Kleen Chicago Recycle Center, April 14, 1994.
- LTI, Safety-Kleen Chicago Recycle Center Phase I RFI Report, June 30, 1994.
- LTI, Third Quarterly Report for the Safety-Kleen Chicago Recycle Center, July 14, 1994.
- IEPA, Response to Phase I RFI Report, September 30, 1994.

TABLES

TABLE 1. HISTORIC STATIC WATER LEVEL AND WELL CONSTRUCTION DATA, Safety-Kleen, Chicago Recycle Center

WELL I.D.	P1	P2	P3	P4**	MW1	MW2	MW3	MW4	MW5	MW6	MW7	MW8	MW9	MW10
Top of Casing Elevation (ft.) [*]	---	594.82	595.02	594.84	594.02	593.87	593.21	---	---	---	---	---	---	---
Top of Casing Elevation (ft.) ^{^^}	596.63	595.26	595.44	---	594.44	594.30	593.61	597.45	597.43	594.26	597.78	596.61	596.72	594.23
Ground Elevation (ft.) [^]	---	593.25	593.19	593.54	594.08	594.19	593.36	---	---	---	---	---	---	---
Ground Elevation (ft.) ^{^^}	594.10	593.72	594.44	---	594.91	594.55	593.95	594.69	594.49	594.62	594.74	593.92	594.03	594.58
Well Depth (ft. from top of casing) ^{^^^}	6.00	6.00	6.00	6.00	9.21	10.24	10.34	12.68	12.75	9.53	13.23	13.58	12.99	8.49
Screen Bottom Elevation (ft.) ^{^^}	590.63	589.26	589.44	588.84	585.23	584.06	583.27	584.77	584.68	584.73	584.55	583.03	583.73	585.74
STATIC LEVEL DATA*	reading elev.	reading elev.	reading elev.	reading elev.	reading elev.	reading elev.	reading elev.	reading elev.	reading elev.	reading elev.	reading elev.	reading elev.	reading elev.	reading elev.
22-Oct-91	---	---	---	591.92	---	592.08	---	592.44	---	---	---	---	---	---
7-Nov-91	---	---	---	591.47	---	591.35	---	590.69	---	588.22	---	591.75	---	590.48
16-Dec-93	3.67	592.96	4.13	591.13	4.29	591.15	---	---	5.75	588.69	3.05	591.25	2.83	590.78
14-Feb-94***	---	---	4.51	590.75	5.63	589.81	---	---	4.31	590.13	3.99	590.31	3.81	589.80
25-May-94	---	---	---	---	---	---	---	---	5.61	588.83	2.93	591.37	2.73	590.88
4-Oct-94	---	---	---	---	---	---	---	---	6.04	588.40	3.68	590.62	2.95	590.66
	6.51	590.94	6.85	590.58	3.86	590.40	7.21	590.57	5.59	591.02	6.66	590.06	3.30	590.93

* measured relative to top of casing notch for post-1991 static level data

** casing damaged sometime prior to December 1993

*** statics for P-2 and P-3 measured on 16 Feb, 1994; no reading taken for P-1 because of an obstruction

[^] surveyed 1991

^{^^} surveyed December, 1993

^{^^^} As measured December 16, 1993; except for P1, P2, P3, P4, which were installed with 3' screens and 3' riser pipe

TABLE 2. SUMMARY OF DETECTED COMPOUNDS IN SOIL AND OCCURRENCE, Safety-Kleen Chicago Recycle Center

[illegible]

na: not analyzed
B: blank contamination detected in sample
~: quantitation approximate

TABLE 3: SUMMARY OF DETECTED COMPOUNDS IN GROUNDWATER AND OCCURRENCE, Safety-Kleen Chicago Recycle Center

[illegible]

* metals analyzed for MW2 only in February, 1994 as part of Appendix I scan
B: Blank contamination detected in sample
na: not analyzed
~: quantitation approximate
italic: compound first detected in May, 1994

TABLE 4a: SELECTED CHARACTERISTICS OF VARIOUS CHLORINATED AND NON-CHLORINATED VOCs DETECTED AT THE SAFETY-KLEEN CHICAGO RECYCLE CENTER

Organic Compounds	Matrix of Occurrence at CRC	Molecular Formula	Molecular Weight (g/mol)	Melting Point (°C)	Boiling Point (°C)	Density (g/cm³ at 20°C)	LeBas Molar Volume (cm³/mole)	Flash Point (C°)	Water Solubility (g/m3 or mg/l at 20°C)	Vapor Pressure (Pa at 20°C)	Henry's Law Constant (Pa-m³/mol at 20°C)	log-K _{ow}	log-K _{oc}		Biodegradability in Soil half-life (hours)	Biodegradability in Groundwater half-life (hours)	
													range[1]	soil, sand, loess (at 20°C)**			
Volatiles																	
Vinyl chloride	S,GW	H ₂ C=CHCl	62.5	-153 ~ -160	-13.37 ~ -13.9	0.9106	65.3	-78.0	90 ~ 6800	308000 ~ 354578	1537 ~ 377000 *	0.6 ~ 1.39	0.477 ~ 1.756	[1] 0.477	[2] 0.39	672~4320	1344~69000
1,1-Dichloroethene	S,GW	CH ₂ =CCl ₂	96.94	-122.1 ~ -122.6	31.56 ~ 37.0	1.2129 ~ 1.220	86.2	-15.0	400 ~ 2640	65900 ~ 78647	2101 ~ 19249	1.48 ~ 2.13	1.813 ~ 2.176	nd	1.81	672~4320	1344~3168
1,1-Dichloroethane	S,GW	CH ₃ CHCl ₂	98.96	-96.7 ~ -97.40	57.0 ~ 57.50	1.174 ~ 1.1757	94.0	-6.0	4997 ~ 5500	23994 ~ 24440	432 ~ 466	1.78 ~ 1.92	1.477 ~ 1.663	nd	1.48	768~3696	1344~8640
1,2-Dichloroethane	S,GW	CH ₂ ClCH ₂ Cl	98.96	-35.3 ~ -35.70	83.0 ~ 84.3	1.2351 ~ 1.260	94.0	13.0	8000 ~ 9621	8131 ~ 8930	92 ~ 101.3	1.3 ~ 1.79	1.06 ~ 2.18	nd	1.15, 1.279	2400~4320	2400~8640
1,2-Dichloroethene (cis)^	S,GW	CHCl=CHCl	96.94	-80.0 ~ -81.47	60.0 ~ 60.7	1.280 ~ 1.2837	86.2	nd	800 ~ 6409	21767	299.8 ~ 453.3	1.51 ~ 1.86	1.69	nd	nd	672~4320	1344~69000
1,2-Dichloroethene (trans)^	S,GW	ClCH=CHCl	96.94	-49.44 ~ -50	47.5 ~ 48.0	1.2546 ~ 1.260	86.2	2.0	600 ~ 6000	26660 ~ 43456	729.4 ~ 6788	1.48 ~ 2.09	1.56 ~ 1.77	nd	1.77	nd	nd
1,1,1-Trichloroethane	S,GW	CH ₃ CCl ₃	133.41	-30.4 ~ -32.5	71 ~ 81	1.3303 ~ 1.350	115.0	<=25	440 ~ 4400	12797 ~ 13330	399.9 ~ 3433	1.96 ~ 2.6	1.65 ~ 3.02	1.65	nd	3360~6552	3360~13104
1,1,2-Trichloroethane	S,GW	CH ₂ ClCHCl ₂	133.41	-35 ~ -36.7	113.0 ~ 147.0	1.4319 ~ 1.4416	115.0	nd	4370 ~ 4921	2368.9 ~ 2533	70.92 ~ 81.1	1.89 ~ 2.42	1.748 ~ 1.845	nd	2.017, 2.18	3263~8760	3263~17520
Trichloroethene	S,GW	CHCl=CCl ₂	131.39	-73.0 ~ -87.15	86.0 ~ 87.30	1.4554 ~ 1.4649	107.0	32.2	1016 ~ 7731	7700 ~ 8580	682.8 ~ 1066	2.04 ~ 3.57	0.30 ~ 3.43	nd	1.75	4320~8640	7704~39672
Tetrachloroethene	S,GW	CCl ₂ =CCl ₂	165.83	-19.0 ~ -22.7	120.97 ~ 121.4	1.6145 ~ 1.630	128.0	nd	150~200	1866 ~ 1906	1175 ~ 2799	2.39 ~ 3.40	1.81 ~ 4.03	2.64	2.322~2.63	4320~8640	8640~17280
Chloroethane	S,GW	C ₂ H ₅ Cl	64.52	-136 ~ -139.0	12.26 ~ 12.40	0.8706 ~ 0.9214	72.7	-50.0	4700 ~ 5740	100700 ~ 133300	942.2 ~ 14994	1.20 ~ 1.55	1.173 ~ 2.16	nd	0.51	168~672	336~1344
Methylene Chloride	S,GW	CH ₂ Cl ₂	84.94	-94.92 ~ -97.0	39.64 ~ 42.0	1.3163 ~ 1.330	71.0	>=30	13200 ~ 20000	46508 ~ 48255	173.0 ~ 229.1	1.01 ~ 1.51	0.944 ~ 1.44	nd	0.94	nd	nd
Chloroform	S,GW	CHCl ₃	119.38	-63.2 ~ -64.0	61.0 ~ 71.3	1.4799 ~ 1.4985	92.0	nd	7925 ~ 8220	11997 ~ 32792	237.4 ~ 486.3	1.43 ~ 2.22	1.44 ~ 2.79	1.44	1.64~1.94	672~4320	1344~43200
Acetone	S,GW	C ₃ H ₆ O	58.08^^	-95.35^^	56.2^^	0.7899^^	nd	-17.0	nd	nd	nd	0.24^^	nd	nd	nd	24~168	48~336
4-Methyl-2-Pentanone	S,GW	C ₆ H ₁₂ O	100.16^^	-84.7^^	116.8^^	0.7978^^	nd	22.8	nd	nd	nd	1.09^^	0.79^^	nd	0.79	nd	nd
Carbon Disulfide	S,GW	CS ₂	76.13^^	-111.5^^	46.2^^	1.2632^^	nd	nd	nd	nd	nd	1.84^^	2.38~2.55^^	nd	2.35~2.64	nd	nd
Benzene	S,GW	C ₆ H ₆	78.11	5.53	80.1	0.8765	96.0	-11.0	1710	3746 ~ 13172^^	441 ~ 740	1.56 ~ 2.69	1.09 ~ 2.53	nd	1.69~2.00	120~384	240~17280
Ethylbenzene	S,GW	C ₂ H ₅ C ₆ H ₅	106.2	-95	136.2	0.867	140.4	15.0	152 ~ 208	1266 ~ 1319^^	668 ~ 1001*	2.68 ~ 3.43	1.98 ~ 3.04	nd	2.41	72~240	144~5472
Toluene	S,GW	C ₆ H ₅ CH ₃	92.13	-95	110.6	0.8669	118.0	4.4	566 ~ 739	855 ~ 4000^^	519 ~ 594	1.83 ~ 3.06	1.12 ~ 3.28	nd	1.57~2.25	96~528	168~672
o-Xylene^	S,GW	C ₆ H ₄ (CH ₃) ₂	106.2	-25.2	144	0.8802	140.4	17.0	112.8 ~ 655^^	871 ~ 933^^	519 ~ 594	2.12 ~ 3.42	1.68 ~ 2.73	nd	2.11~2.41	168~672	336~8640
m-Xylene^	S,GW	C ₆ H ₄ (CH ₃) ₂	106.2	-47.4	139.3	0.8842	140.4	25.0	122 ~ 223^^	1100 ~ 1166^^	506 ~ 1115*	3.04 ~ 3.50	2.04 ~ 3.15	nd	3.2	168~672	336~8640
p-Xylene^	S,GW	C ₆ H ₄ (CH ₃) ₂	106.2	13.2	138	0.8611	140.4	27.2	78 ~ 223^^	1160 ~ 1206^^	506 ~ 1185*	2.85 ~ 3.50	2.05 ~ 3.08	nd	2.31, 2.42	168~672	336~8640
Chlorobenzene	GW	C ₆ H ₅ Cl	112.56	-45.0 ~ -45.8	125.7 ~ 131.7	1.1058~1.107	116.9	28.0	500	1427	273 ~ 346	2.13 ~ 3.18	1.92 ~ 2.92	nd	1.92~2.52	1632~3600	3264~7200
Chloromethane	GW	CH ₃ Cl	50.49	-97.1 [2]	-23.7	0.92	nd	-46.0	nd	5^^	0.01 [2]	0.90,0.91 [3]	nd	nd	1.4	nd	nd
2-Butanone	S,GW	C ₄ H ₈ O	72.11	-86.9	79.6	0.8054	96.2	-9.0	294000	288200^^	1.05~7x10 ⁻⁵	0.26,0.29	nd	nd	0.09	nd	nd
Carbon Tetrachloride	GW	CCl ₄	153.82	-21.2 ~ -23.0	76.0 ~ 77.0	1.590 ~ 1.594	113.0	nd	778 ~ 805	11997 ~ 17170	2067 ~ 3081	2.03 ~ 3.00	1.26 ~ 2.642	nd	2.35~2.64	4320~8640	168~8640
1,2-Dichloropropane	S,GW	C ₃ H ₆ Cl ₂	112.99	-100.4~70	96.4	1.56	116.0	15.6	2700	5332~8791^^	2.94x10 ⁻³	2.28	nd	nd	1.431, 1.71	4008~30936	8016~61872
trans-1,3-Dichloropropene	GW	C ₃ H ₄ Cl ₂	110.97	-84	77	1.1818	nd	5.3	2800	nd	3.55x10 ⁻³	1.41	nd	nd	1.415, 1.68	133~271	133~271****
Styrene	S,GW	C ₈ H ₈	104.15	-30.6	145.2	0.906	133.0	31.0	300	335~1333^^	2.61x10 ⁻³	2.95, 3.16	nd	nd	2.87	336~672	672~5040
Tetrahydrofuran	S,GW	C ₄ H ₈ O	72.11	-108,-65	67	0.8892	81.0	-17.2	nd	17526~26340^^	7.06x10 ⁻⁵	0.46	nd	nd	nd	nd	nd
Trichlorotrifluoroethane	S,GW	CCl ₂ FCCLF ₂	187.38	nd	47.7 [3]	nd	nd	nd	nd	nd	0.53	1.66	nd	nd	nd	nd	nd

^ 1,2-Dichloroethene (total) and total xylene were analyzed at the CRC
^^ at 25°C
^^^ Montgomery, 1991
gw = groundwater
s = soil

* temperature not stated
** Grathwohl, 1990; calculation for TCE at 20°C, media unk
*** at 0°C
**** cis,trans not seperated
nd no data

[1] Illustrated Handbook of Physical-Chemical Properties and Environmental Fate for Organic Chemicals by Donald Mackay, Wan Ying Shiu and Kuo Ching Ma 1993
[2] Groundwater Chemical Field Guide by John h. Montgomery, 1991
[3] Material Safety Data Sheet by Genium Publishing Corp. 1984
[4] Handbook of Environmental Degradation Rates by Philip H. Howard, 1991

TABLE 4b: SELECTED CHARACTERISTICS OF VARIOUS CHLORINATED AND NON-CHLORINATED SVOCs DETECTED AT THE SAFETY-KLEEN CHICAGO RECYCLE CENTER

Organic Compounds	Matrix of Occurrence at CRC	Molecular Formula	Molecular Weight (g/mol)	Melting Point (°C)	Boiling Point (°C)	Density (g/cm³ at 20°C)	LeBas Molar Volume (cm³/mole)	Flash Point (C°)	Water Solubility (g/m3 or mg/l at 20°C)	Vapor Pressure (Pa at 20°C)	Henry's Law Constant (Pa·m³/mol at 20°C)	log-K _{ow}	log-K _{oc}		Biodegradability in Soil half-life (hours)	Biodegradability in Groundwater half-life (hours)	
			[1]/[2]	[1]/[2]			[1]	[2]/[3]		[1]							
			range[1]	soil, sand, loess (at 20°C)**	[4]	[4]											
Semi-Volatiles																	
Phenol	S,GW	C ₆ H ₆ O	94.11 ^{^^}	43 ^{^^}	181.7 ^{^^}	1.0576 ^{^^}	nd	79.0	nd	nd	nd	1.39-1.48 ^{^^}	[1]	[2]			
1,2-Dichlorobenzene	GW	C ₆ H ₄ Cl ₂	147.01	-16.7 ~ 25	177.0 ~ 180.5	1.3048 ~ 1.306	137.8	66.0	124 ~ 148	133 - 208	122 - 170	2.97 - 3.90	1.43-3.46 ^{^^}	nd	nd	24~240	12~168
2-Methylnaphthalene	S,GW	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	2.97 - 3.90	2.26 - 4.5	nd	nd	672~4320	1344~8640
Phenanthrene	S,GW	C ₁₄ H ₁₀	178.24	96.3 ~ 102	338 ~ 340	0.9800 ~ 1.174	199.0	171.0	2.67	nd	nd	nd	nd	nd	nd	nd	nd
Fluoranthene	S	C ₁₆ H ₁₀	202.26	107 ~ 111	217 ~ 393	1.252***	217.0	nd	0.190 ~ 0.240	0.0144 - 0.091	0.691 - 22.896*	3.60 - 5.92	3.58 - 6.12	nd	nd	384~4800	768~9600
Benzo (a) anthracene	S	C ₁₈ H ₁₂	228.3	155 ~ 167	435	1.2544	248.0	nd	0.0086 ~ 0.044*	0.0007	0.134 - 220	4.70 - 6.50	4.0 - 6.38	nd	nd	3360~10560	6720~21120
Chrysene	S	C ₁₈ H ₁₂	228.3	252 ~ 256	441 ~ 488	1.274 ~ 1.2826	251.0	nd	0.0086 ~ 0.044*	6.67x10 ⁻⁷ - 2.93x10 ⁻⁶	0.1013	5.48 - 7.50	4.0 - 7.30	nd	nd	nd	nd
bis(2-ethylhexyl)phthalate	S,GW	nd	nd	nd	nd	nd	nd	nd	0.00102 ~ 0.017*	5.70x10 ⁻⁷ - 4.0x10 ⁻⁶ ^^	0.1064 - 218.15*	5.01 - 7.10	3.66 - 6.90	nd	nd	8904~24000	17808~48000
Benzo(b)fluoranthene	S	C ₂₀ H ₁₂	252.32	167 ~ 168	481	nd	268.9	nd	0.0015 ~ 0.014^^	6.67x10 ⁻⁵	0.054 - 3.55*	5.78 - 6.60	5.70 - 5.74	nd	nd	120~550	240~9336
Benzo(k)fluoranthene	S	C ₂₀ H ₁₂	252.32	198 ~ 217	480 ~ 481	nd	268.9	nd	0.0007 ~ 0.008^^	1.28x10 ⁻⁸ - 6.70x10 ⁻⁵	0.111 - 7.50*	6.06 - 7.20	4.00 - 7.00	nd	nd	8640~14640	17280~29280
Benzo(a)pyrene	S	C ₂₀ H ₁₂	252.32	175 ~ 179	311 ~ 496	nd	263.0	nd	0.0005	8.53x10 ⁻¹⁰ - 1.22x10 ⁻⁵ ^^	0.0079 - 1214.7*	4.05 - 8.50	4.0 - 8.3	nd	nd	21840~51360	42680~102720
Meno(1,2,3-cd)pyrene	S	C ₂₂ H ₁₂	276.34 ^{^^}	160-163 ^{^^}	536 ^{^^}	nd	nd	nd	nd	nd	nd	5.97 ^{^^}	7.49 ^{^^}	nd	nd	1368~12720	2736~25440
Benzo(g,h,i)perylene	S	C ₂₂ H ₁₂	276.34	222 ~ 278	525	nd	277	nd	0.00022 ~ 0.00083^^	nd	nd	5.97 ^{^^}	7.49 ^{^^}	nd	nd	14400~17520	28800~35040
Benzo(g,h,i)perylene	S	C ₂₂ H ₁₂	276.34	222 ~ 278	525	nd	277	nd	0.00022 ~ 0.00083^^	1.33x10 ⁻⁸	0.001 - 0.709*	6.25 - 7.23	6.20 - 6.26	nd	nd	14160~15600	28320~31200
Benzyl Alcohol	GW	C ₇ H ₈ O	108.14	-15.3 ~ -9	205.3	nd	nd	93	35000	nd	nd	1.1	nd	nd	1.98	nd	nd
Benzoic Acid	S,GW	C ₇ H ₆ O ₂	122.12	122.13	249.2	nd	nd	121	2900	nd	7.02x10 ⁻⁸	1.81~2.03	1.48~2.70	nd	1.48~2.70	nd	nd
2-Methylphenol	S,GW	C ₇ H ₈ O	108.14	30.9	191	nd	nd	81	24500	nd	1.23x10 ⁻⁶	1.93~1.99	nd	nd	1.34	nd	nd
4-Methylphenol	S,GW	C ₇ H ₈ O	108.14	34.8	201.9	nd	nd	86	23000	nd	7.92x10 ⁻⁷	1.67~3.01	nd	nd	1.69~3.53	nd	nd
Isophorone	GW	C ₉ H ₁₄ O	138.21	-8.1	215.2	nd	nd	84.4	12000	nd	5.8x10 ⁻⁶	1.67,1.70	nd	nd	1.49	168~672	336~1344
2,4-Dimethylphenol	S,GW	C ₈ H ₁₀ O	122.17	27~28	210	0.965	nd	>110	4200	nd	6.55x10 ⁻⁶	2.3~2.5	nd	nd	2.07	24~168	48~336
Naphthalene	S,GW	C ₁₀ H ₈	128.18	80.5	217.942	1.162	148	79	30	6.558~66.7^^	7.34x10 ⁻⁴	3.2~4.7	2.38~5.00	nd	2.72~3.52	398~1152	24~6192
4-Chloro-3-Methylphenol	GW	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
2,6-Dinitrotoluene	GW	C ₇ H ₆ N ₂ O ₄	182.14	60.5	285	nd	nd	206.7	300	nd	2.17x10 ⁻⁷	2	nd	nd	1.79	672~4320	48~8640
Acenaphthene	S,GW	C ₁₂ H ₁₀	154.21	89.9	279	1.042~1.069	173	nd	3.47~4.16	0.122~4.02^^	1.5x10 ⁻⁴	3.92,4.33	nd	nd	1.25	295~2448	590~4896
Dibenzofuran	S,GW	C ₁₂ H ₈ O	168.2	86~87	287	1.0886	226.4	nd	10	0.35~2.026^^	nd	4.12~4.31	nd	nd	3.91~4.10	168~672	205~835
Fluorene	S,GW	C ₁₃ H ₁₀	166.22	107	375	1.203	188	nd	0.166	0.08~1.66^^	6.3x10 ⁻⁵	4.12,4.18	3.76~5.47	nd	3.7	768~1440	1536~2880
Anthracene	S	C ₁₄ H ₁₀	178.24	216.2~216.4	339.9	1.24	nd	121.1	0.0434	nd	1.77~6.51x10 ⁻²	4.34~4.54	3.59~5.38	nd	4.205~4.93	1200~11040	2400~22080
Di-n-Butylphthalate	S	C ₁₆ H ₂₂ O ₄	278.35	-35	340	1.046	nd	157	10.1	nd	6.3x10 ⁻⁵	4.31~4.79	nd	nd	3.14	48~552	48~552
Pyrene	S	C ₁₆ H ₁₀	202.26	156	393	1.271	nd	nd	0.135	0.00017~0.01^^	1.87x10 ⁻⁵	4.88~5.52	3.11~6.51	nd	4.66~5.23	5040~45600	10080~91200
Dibenzo (a,h) Anthracene	S	C ₂₂ H ₁₄	278.36	269~270	524	nd	300	nd	0.0005	1.3x10 ⁻⁹ ^^	7.33x10 ⁻⁹	5.97~6.58	5.20~6.52	nd	6.22	8664~22560	17328~45120
Pyridine	S,GW	C ₅ H ₅ N	79.1	-42	115.5	nd	nd	20	233400	nd	1.2x10 ⁻⁵	0.64~1.28	nd	nd	nd	24~168	48~336
3-Picoline	S,GW	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
1-Methyl-2-Pyrrolidinone	S,GW	C ₅ H ₉ NO	99.15	nd	202	nd	nd	95.6	nd	nd	nd	nd	nd	nd	nd	nd	nd
N,N-Dimethylacetamide	S,GW	C ₄ H ₉ NO	115.18	-20	165	nd	nd	65.6	nd	nd	nd	nd	nd	nd	nd	nd	nd
Acetophenone	GW	C ₆ H ₅ COCH ₃	120.15	20.5	202	1.03	nd	77.0	nd	nd	nd	1.58	nd	nd	nd	nd	nd

^ at 25°C
^^ Montgomery, 1991
^^^ = groundwater
soil
* temperature not stated
** Grathwohl, 1990; calculation for TCE at 20°C, media unk
*** at 0°C
**** cis,trans not seperated
nd no data

[1] Illustrated Handbook of Physical-Chemical Properties and Environmental Fate for Organic Chemicals by Donald Mackay, Wan Ying Shiu and Kuo Ching Ma 1993
[2] Groundwater Chemical Field Guide by John h. Montgomery, 1991
[3] Material Safety Data Sheet by Genium Publishing Corp. 1984
[4] Handbook of Environmental Degradation Rates by Philip H. Howard, 1991

TABLE 5. SUMMARY OF ANALYTES FOR ONSITE GROUNDWATER SCREENING ANALYSES
Safety-Kleen Chicago Recycle Center Phase II Investigation

Vinyl chloride	Benzene
1,1-Dichloroethene	Ethylbenzene
1,2-Dichloroethene (cis)	Toluene
1,2-Dichloroethene (trans)	Xylene (total)
1,1,1-Trichloroethane	Chlorobenzene
Trichloroethene	Styrene
Tetrachloroethene	Tetrahydrofuran
	Trichlorotrifluoroethane

**TABLE 6. LIST OF ORGANIC COMPOUND ANALYTES FOR GROUNDWATER AND PQLs,
Safety-Kleen Chicago Recycle Center Phase II Investigation**

VOCS (SW-846 Method 8240)	PQL (ug/l)*	PNAs (SW-846 Method 8270)	PQL (ug/l)*
Vinyl chloride	2 [^] (10**)	Phenol	100 [^] (100**)
1,1-Dichloroethene	7 [^] (35**)	1,2-Dichlorobenzene	10
1,1-Dichloroethane	5	2-Methylnaphthalene	10
1,2-Dichloroethane	5 [^] (25**)	Phenanthrene	10
1,2-Dichloroethene (cis)	70 [^] (200**)	Benzo (a) anthracene	10 ^{^^}
1,2-Dichloroethene (trans)	100 [^] (500**)	Chrysene	10
1,1,1-Trichloroethane	200 [^] (1000**)	bis (2-ethylhexyl) phthalate	10
1,1,2-Trichloroethane	5	Benzyl Alcohol	20
Trichloroethene	5 [^] (25**)	Benzoic Acid	50 ^{^^}
Tetrachloroethene	5 [^] (25**)	2-Methylphenol	10
Chloroethane	10	4-Methylphenol	10
Methylene Chloride	5	Isophorone	10
Chloroform	5	2,4-Dimethylphenol	10
Acetone	100	Naphthalene	10
4-Methyl-2-Pentanone	50	4-Chloro-3-Methylphenol	20
Carbon Disulfide	5	2,6-Dinitrotoluene	10
Benzene	5 [^] (25**)	Acenaphthene	10
Ethylbenzene	700 [^] (1000**)	Dibenzofuran	10
Toluene	1000 [^] (2500**)	Fluorene	10
Xylene (total)	10,000 [^] (10,000**)	Pyridine	10
Chlorobenzene	100 [^] (500**)	3-Picoline	10 ^{^^}
Chloromethane	10	1-Methyl-2-Pyrolidinone	10 ^{^^}
2-Butanone	100	N,N-Dimethylacetamide	10 ^{^^}
Carbon Tetrachloride	5 [^] (25**)	Acetophenone	10
1,2-Dichloropropane	5 [^] (25**)		
trans-1,3-Dichloropropene	5		
Styrene	100 [^] (500**)		
Tetrahydrofuran	5 ^{^^}		
Trichlorotrifluoroethane	10 ^{^^}		

* PQL is for designated method as specified in 35 IAC 724 Appendix I, unless specified otherwise

[^] IEPA Class I Groundwater Standards are assumed until the groundwater classification proposal for the CRC is approved

** Class II Groundwater Standard

^{^^} Compound not included in 35 IAC 724 Appendix I, or in Class I or Class II standards;
specified PQL was used in 1994 quarterly sampling events

TABLE 7. SUMMARY OF SOIL ANALYTES AND PRELIMINARY TARGET LEVELS, Safety-Kleen Chicago Recycle Center Phase II Investigation

<u>VOC (by SW846 Method 8240)</u>	<u>Soil Preliminary Target Levels (mg/kg)</u>
Benzene	0.025
Chloroform	0.01
1,2-Dichloroethane	0.025
1,1-Dichloroethylene	0.035
Ethylbenzene	1.0
Phenols (total)	0.1
Styrene	0.5
Toluene	2.5
Trichloroethylene	0.025
1,1,2-Trichloroethane	0.05
Vinyl Chloride	0.01
Xylenes (total)	10.0
<u>PNA (by SW-846 Method 8270 or 8310)</u>	
<u>Soil Preliminary Target Levels (mg/kg)</u>	
Acenaphthene	42.0
Anthracene	210.0
Benzo (a) anthracene	0.013
Benzo (a) pyrene	0.02
Benzo (b) fluoranthene	0.018
Benzo (k) fluoranthene	0.017
Chrysene	0.15
Dibenzo (a,h) anthracene	0.03
Fluoranthene	28.0
Fluorene	28.0
Ideno (1,2,4-c,d) pyrene	0.043
Naphthalene	0.039
Pyrene	21.0
<i>Other Noncarcinogenic PNAs (total)</i>	
Acenaphthylene	21.0
Benzo (g,h,i) perylene	
Phenanthrene	

FIGURES

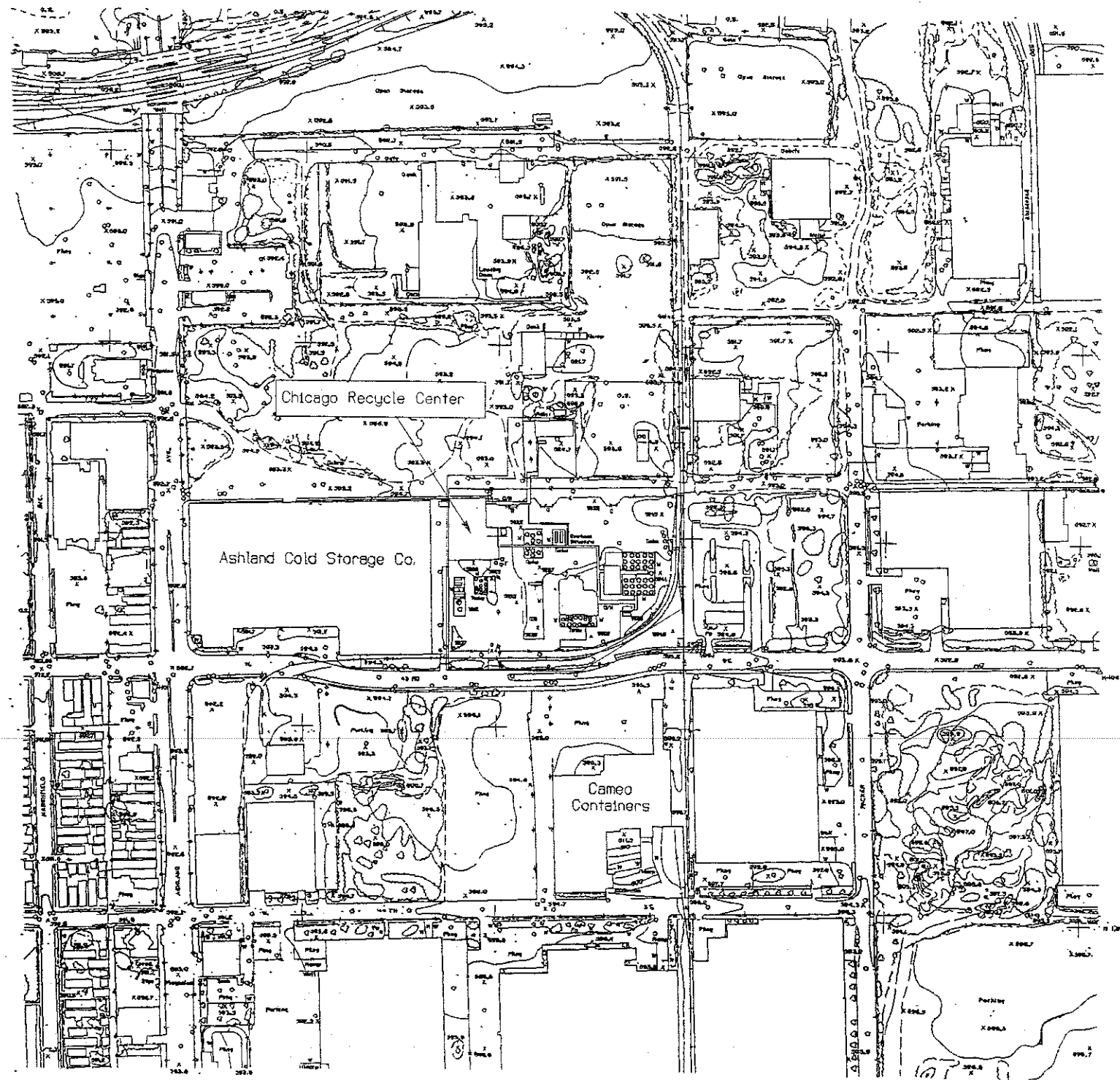
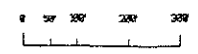


Figure 2:
 Site Topographic Map
 Safety-Kleen Corp.: Chicago Recycle Center
 Cook County, Illinois
 (T38N,R14E, Section 5)

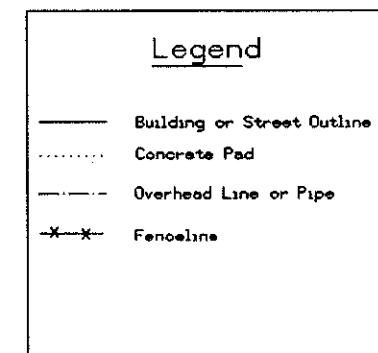
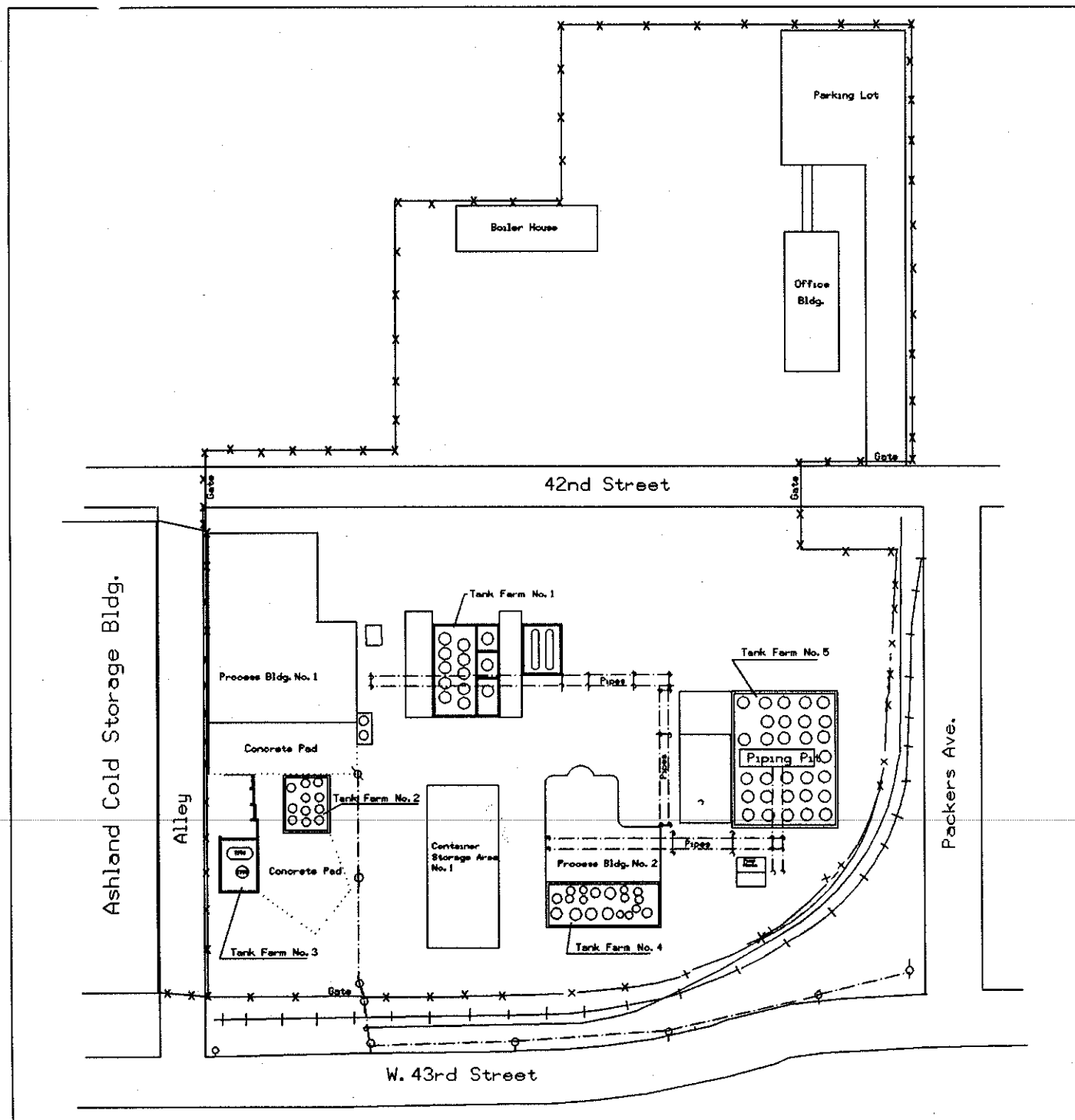


NO.	REVISIONS	BY
3	5/1/93	SBB

LTI-Limno-Tech, Inc.
 Environmental Engineering
 2395 Huron Parkway, Ann Arbor, MI 48104

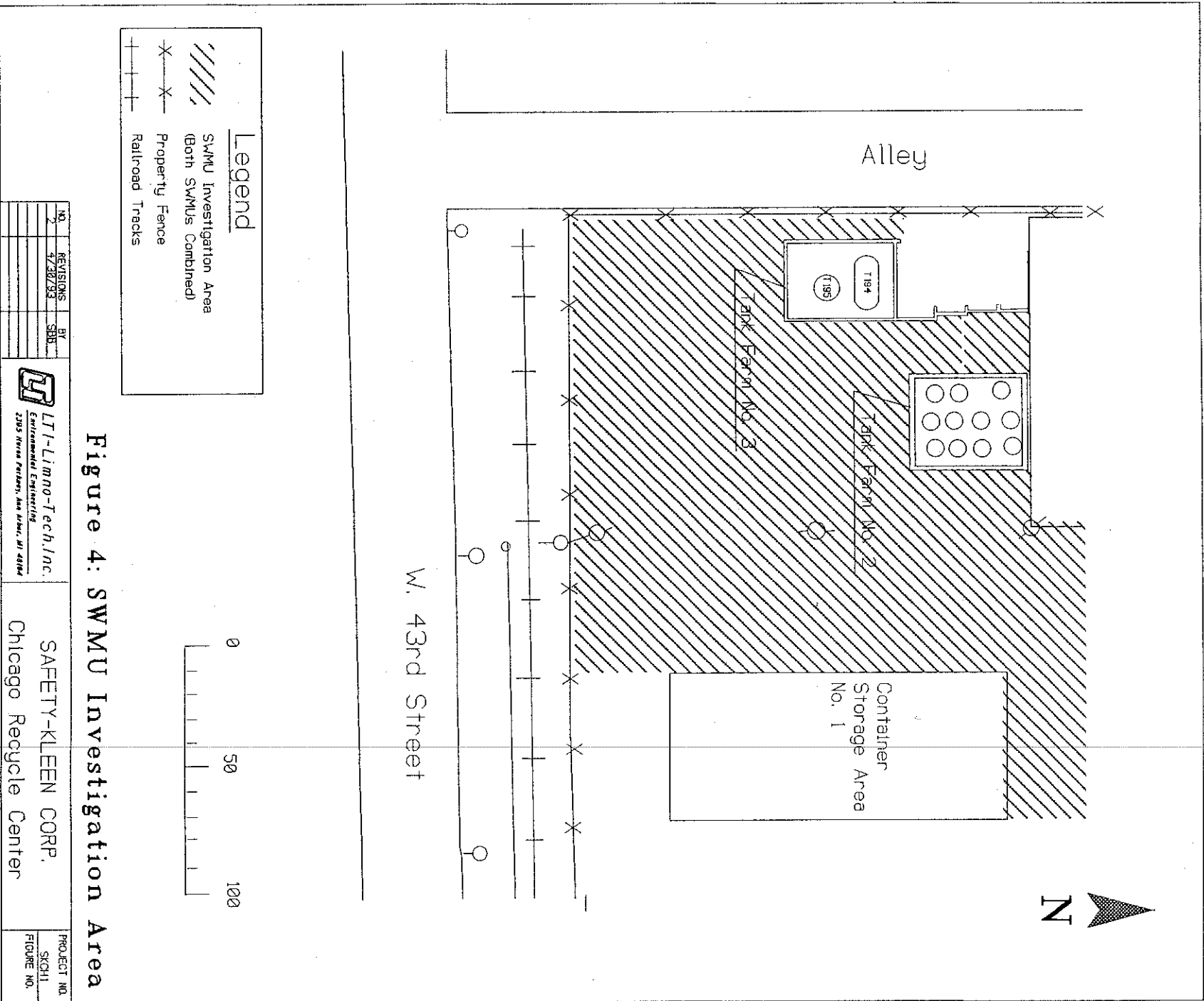
SAFETY-KLEEN CORP.
 Chicago Recycle Center

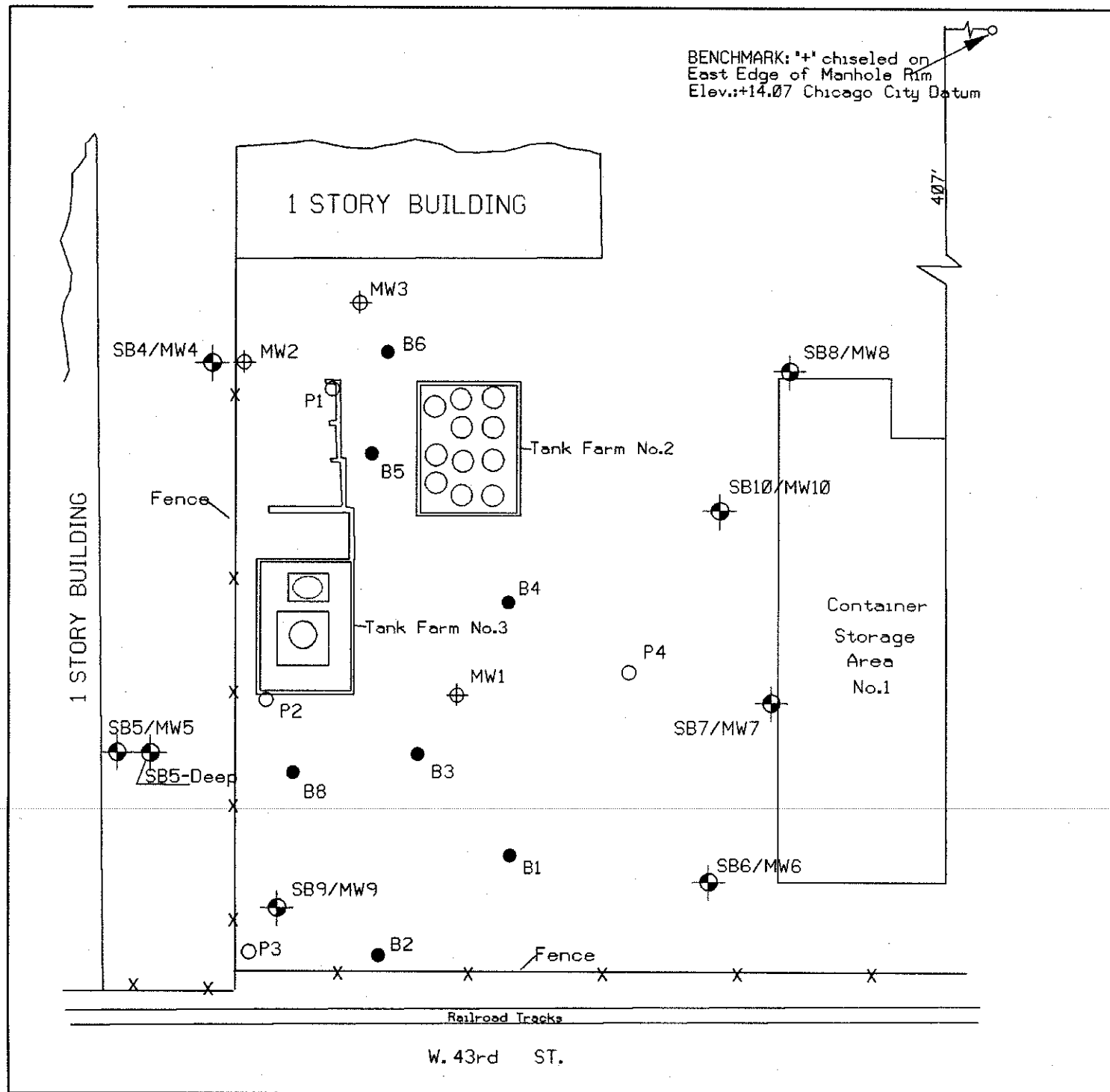
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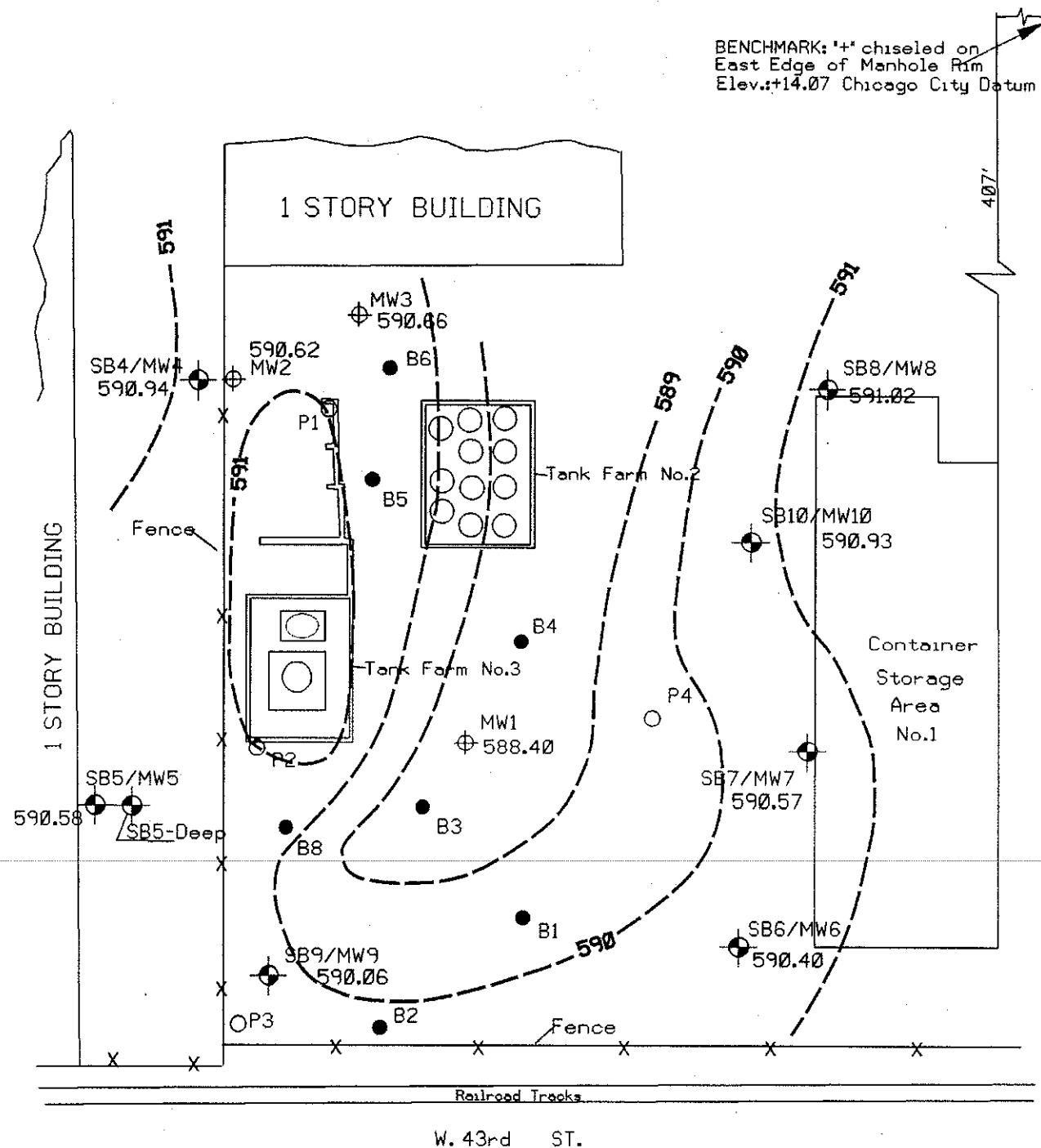
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Chicago Recycle Center

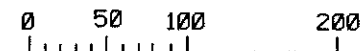
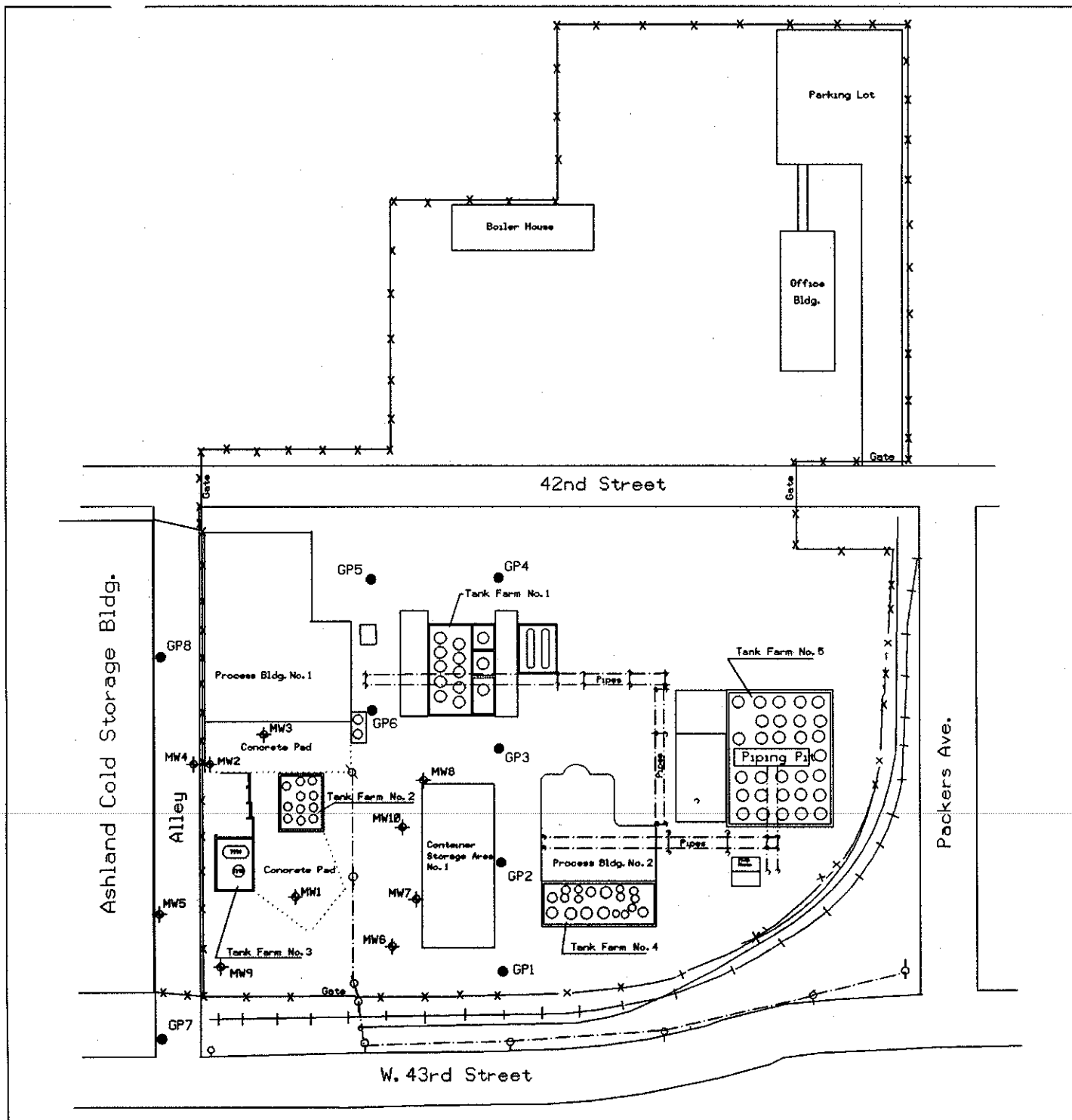
Figure 3
CRC Facility Plan





BENCHMARK: '+' chiseled on
East Edge of Manhole Rim
Elev.: +14.07 Chicago City Datum





Legend

- Building or Street Outline
- Concrete Pad
- Overhead Line or Pipe
- X-X Fenceline
- ◆ MW8 Monitoring Well
- GP4 Proposed Geoprobe Sampling Location

SAFETY-KLEEN CORP.
Chicago Recycle Center

Figure 7

Proposed Geoprobe
Sampling Locations

Attachment A
IEA QAPP

IEA Corporation
Cary, North Carolina

QUALITY ASSURANCE PROGRAM PLAN

prepared by

Toivo E. Niemi
Quality Assurance Manager

and

James A. Ploscyca
Corporate Quality Assurance Director

for

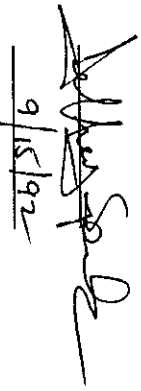
IEA Corporation
Cary, North Carolina

COPY # 1


IEA Corporation
Cary, North Carolina

Quality Assurance Program Plan

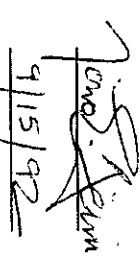
Name: Mr. Jeffrey G. Spink
Title: Vice-President & Director of NC Operations
Location: Cary, North Carolina

Signature: 
Date: 9/15/92

Name: Mr. James A. Ploscyca
Title: Corporate QA Director
Location: Cary, North Carolina

Signature: 
Date: 9/15/92

Name: Mr. Toivo E. Niemi
Title: Quality Assurance Manager
Location: Cary, North Carolina

Signature: 
Date: 9/15/92

QUALITY ASSURANCE PROGRAM PLAN

TABLE OF CONTENTS

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A. Quality Assurance Program Identification Form

Document Title: IEA Corporation Cary, North Carolina Quality Assurance Program Plan

Corporate Address: IEA Corporation
3000 Weston Parkway
Cary, North Carolina 27513
(919) 677-0090

Company Official:
Title: Dr. Richard K. Schmidt
President and Chief Executive Officer, IEA Corporation
Telephone: (919) 677-0090
(800) 444-9919

Company Official:
Title: Mr. Toivo E. Niemi
Quality Assurance Manager
Telephone: (919) 677-0090

Company Official:
Title: Mr. James A. Ploseyca
Corporate Director of Quality Assurance
Telephone: (919) 677-0090

Plan Coverage: IEA Corporation Laboratory in Cary, North Carolina

Location: 3000 Weston Parkway
Cary, North Carolina 27513

Functions: Environmental Testing
Quality Assurance

B. Quality Assurance Policy

It is the intention of IEA - North Carolina to consistently produce analytical data which are accurate, defensible, and fully meet clients' data quality objectives. The contents of this Quality Assurance Program Plan describe the activities which are utilized in order to ensure this commitment is maintained.

IEA - North Carolina Quality Policy

"Management and staff are committed to maintaining a carefully controlled analytical environment in order to ensure the consistent generation of accurate data which meets or exceeds the data quality objectives of our clientele".

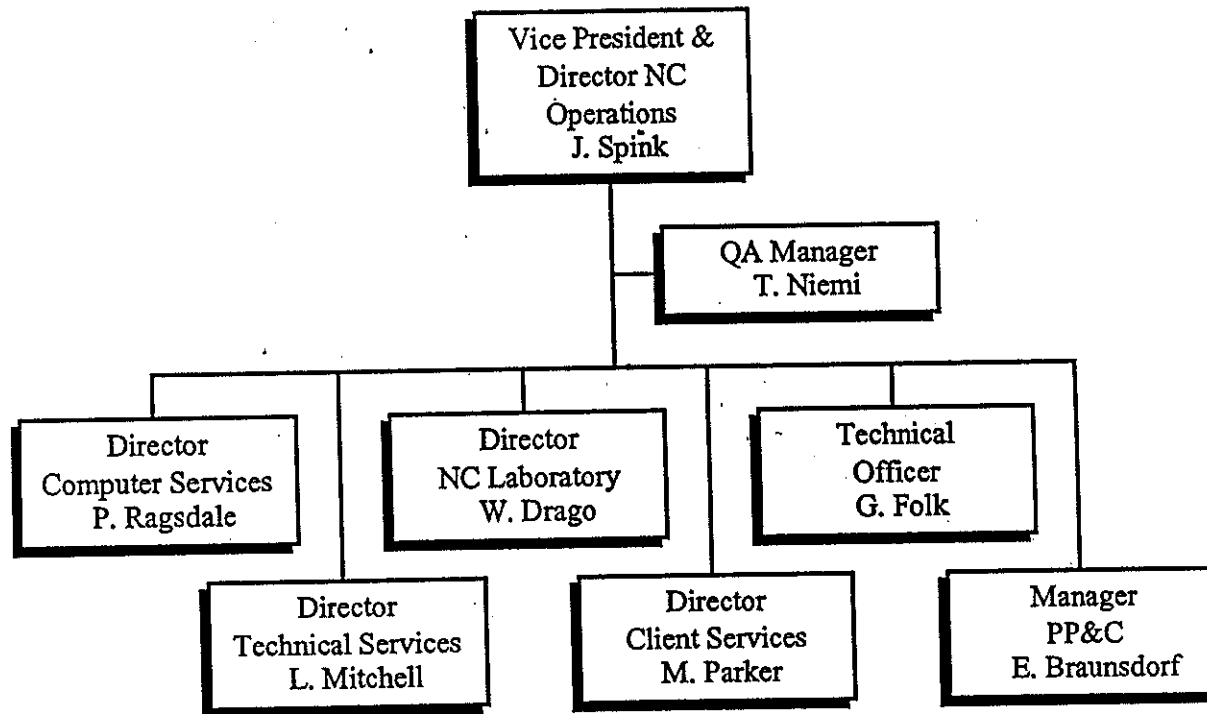
Detailed written analytical procedures are used to ensure strict adherence to published analytical methods throughout the laboratory. Bench-level quality control measures with well defined acceptance criteria are included in each analytical procedure employed by the laboratory. Laboratory records and quality control data are monitored by management on a regular basis.

This manual is written description of the structures employed by IEA to ensure that all data generated by the laboratory is accurate and defensible.

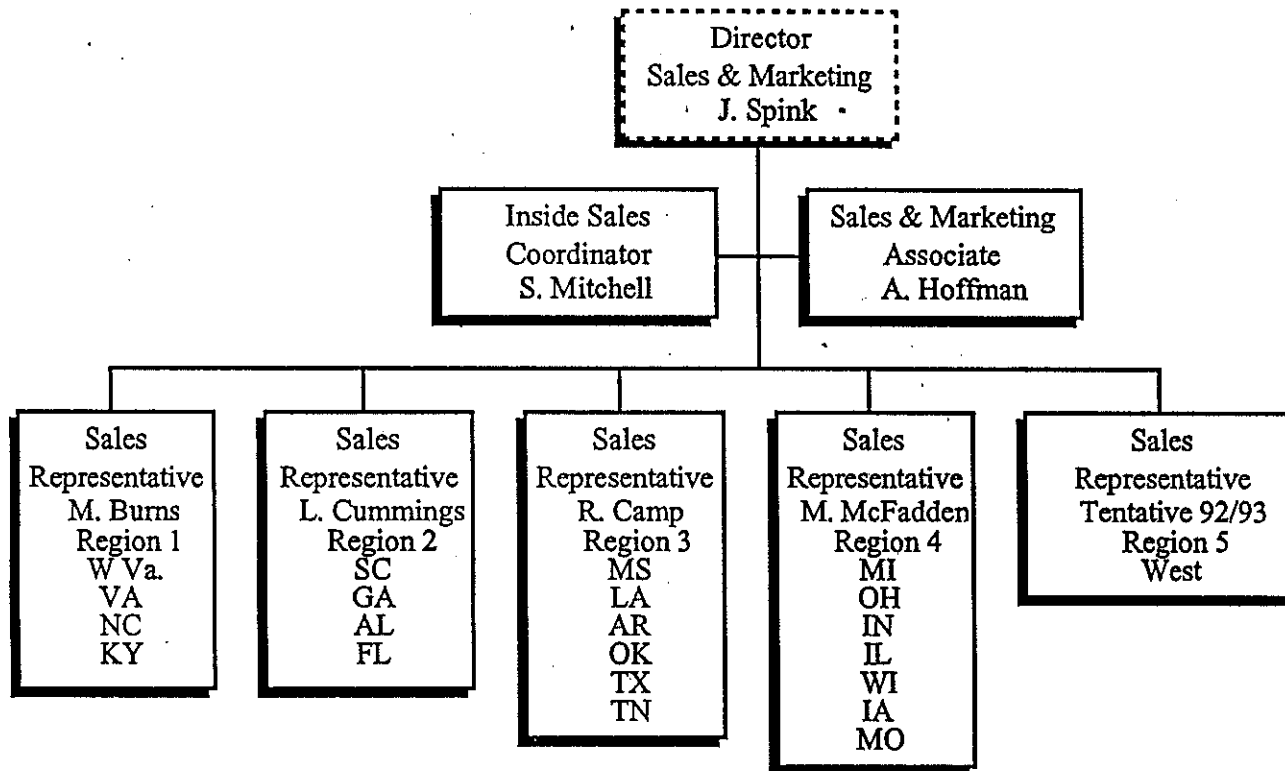
C. Laboratory Organization

The following figures describe the organizational structure of the IEA Corporation Laboratory located in Cary, North Carolina.

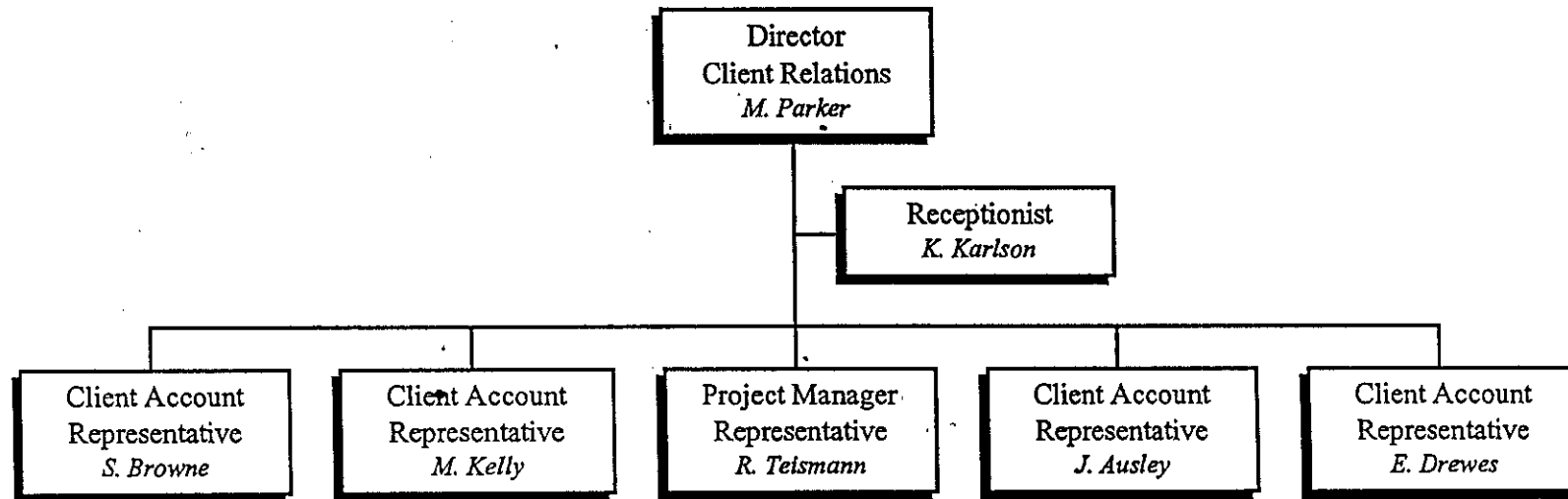
IEA - North Carolina



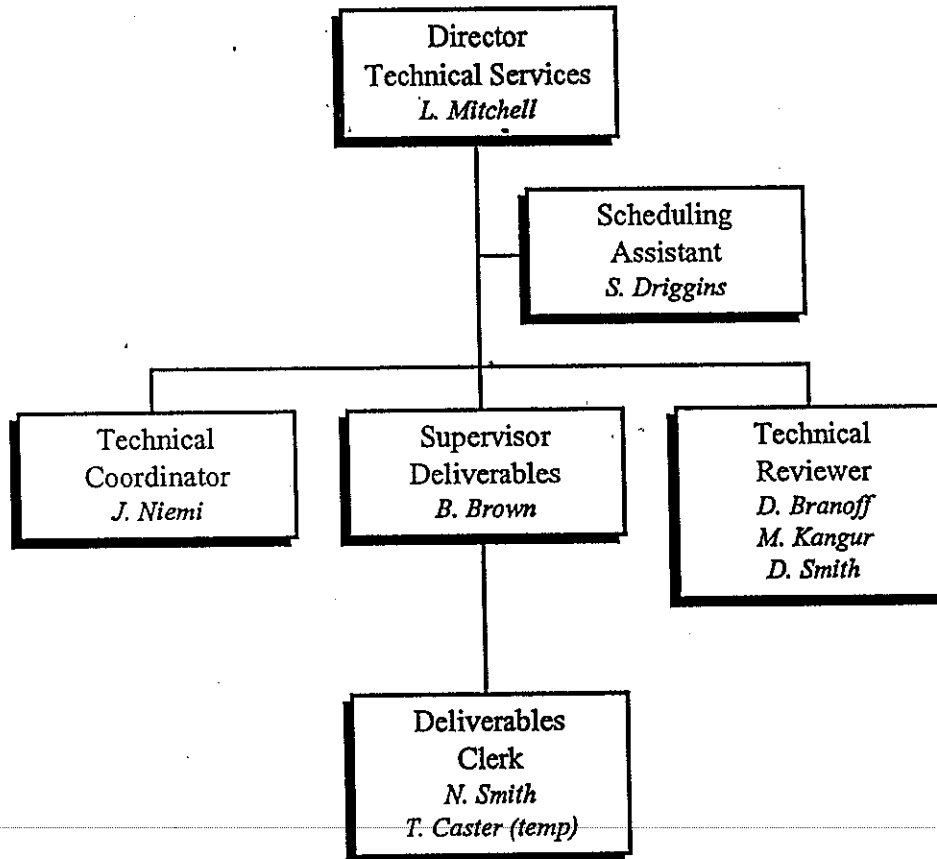
IEA - North Carolina
Sales & Marketing



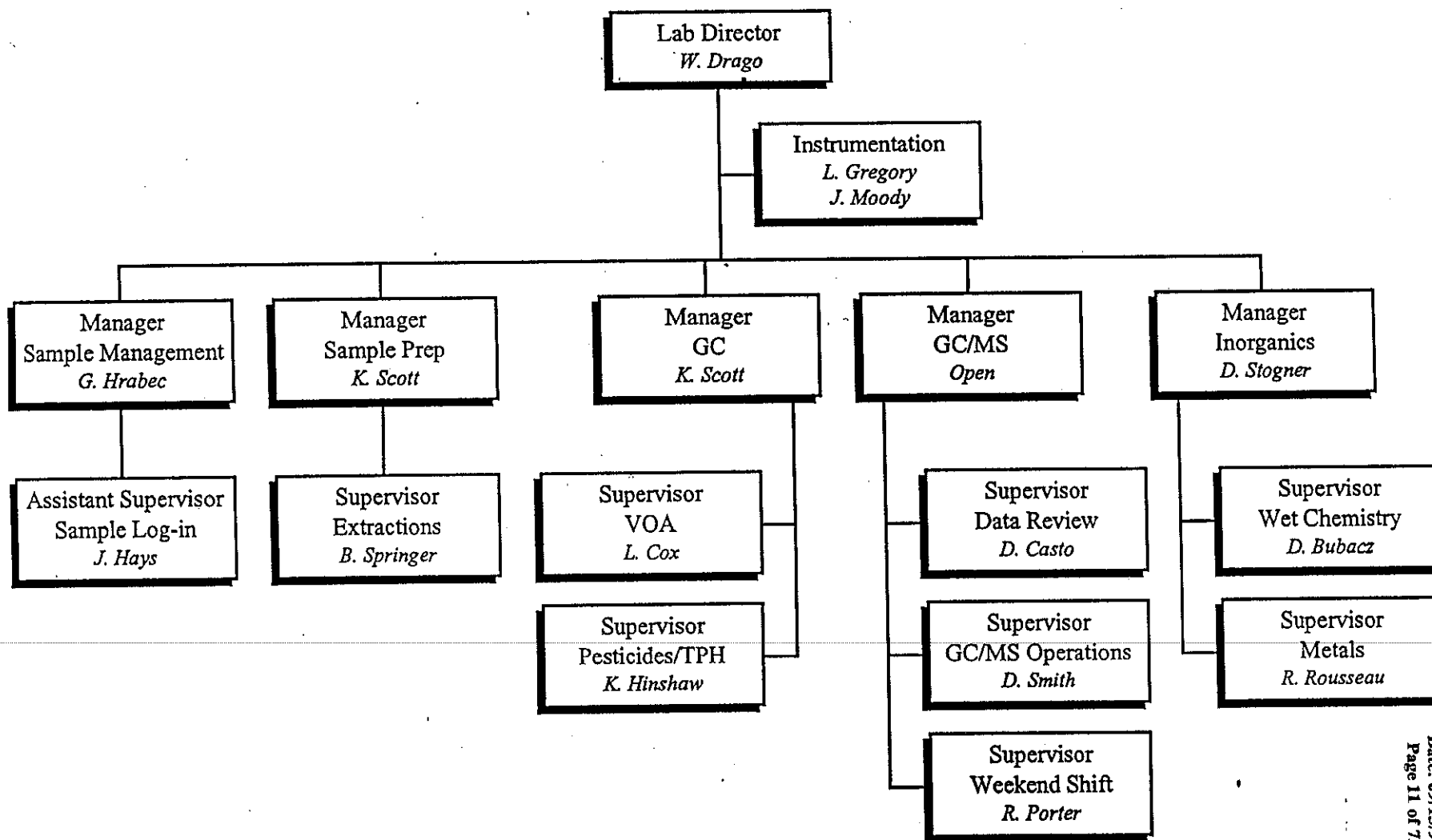
IEA - North Carolina Client Services



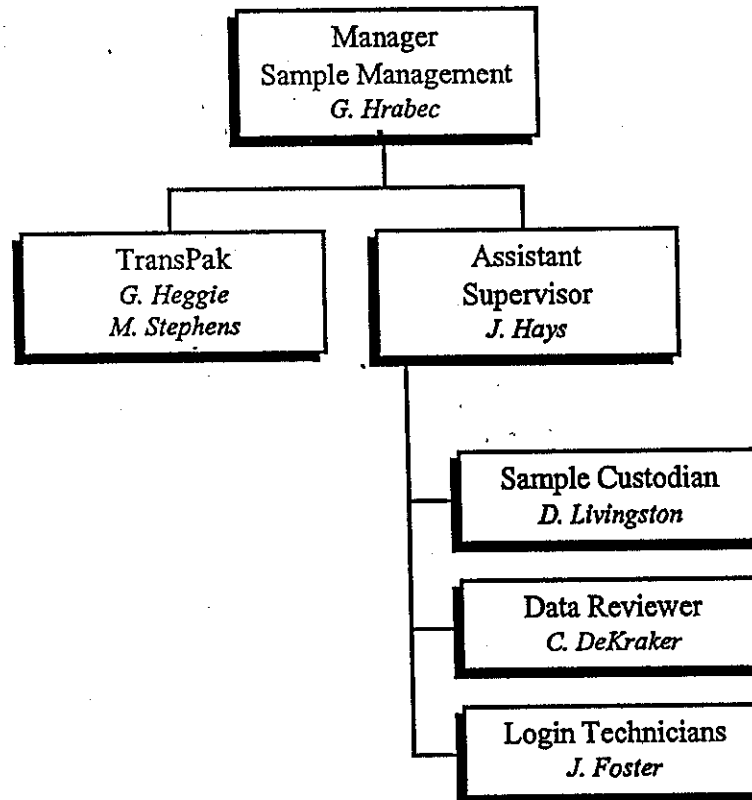
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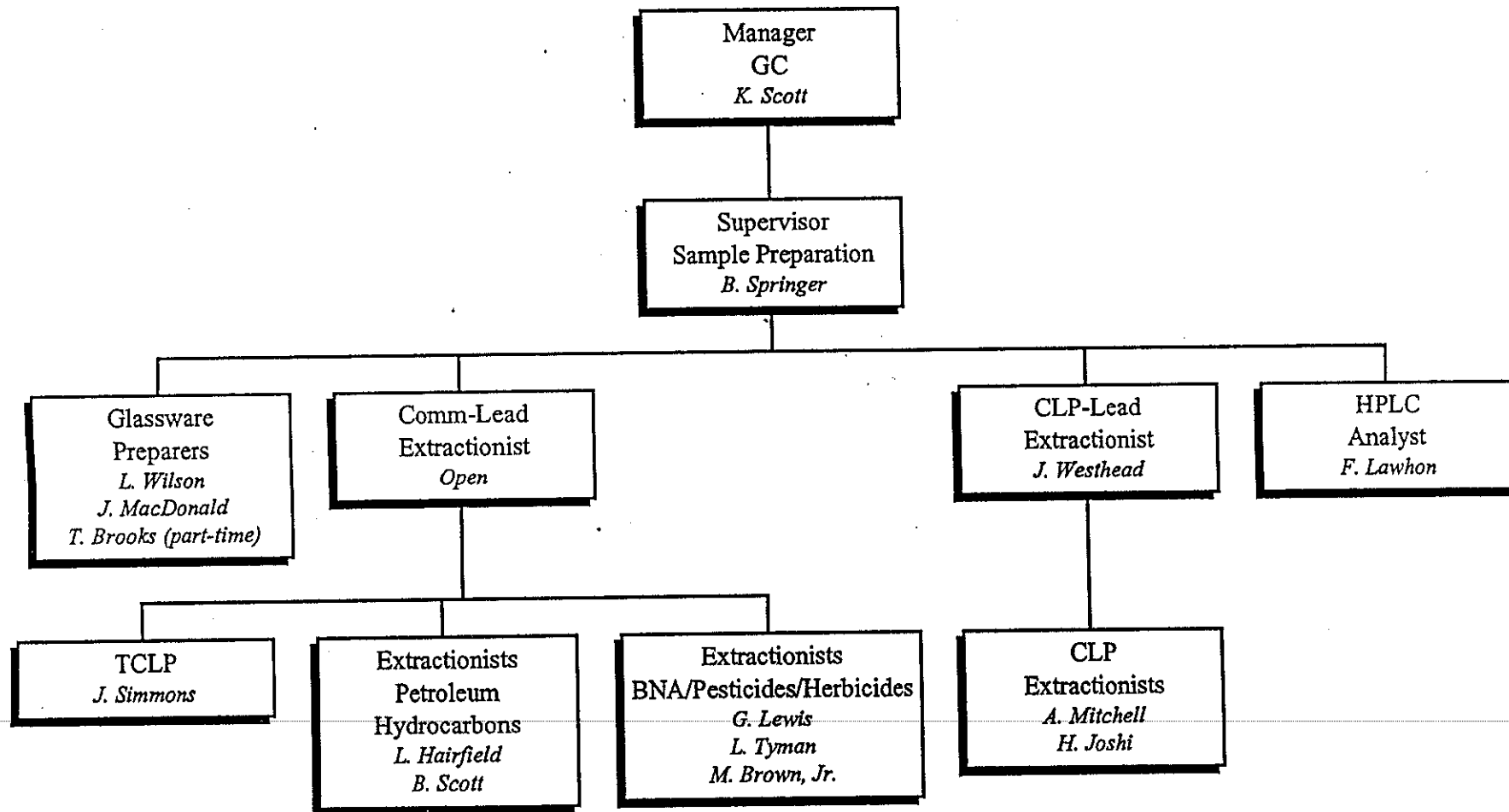
IEA - North Carolina
Lab Operations



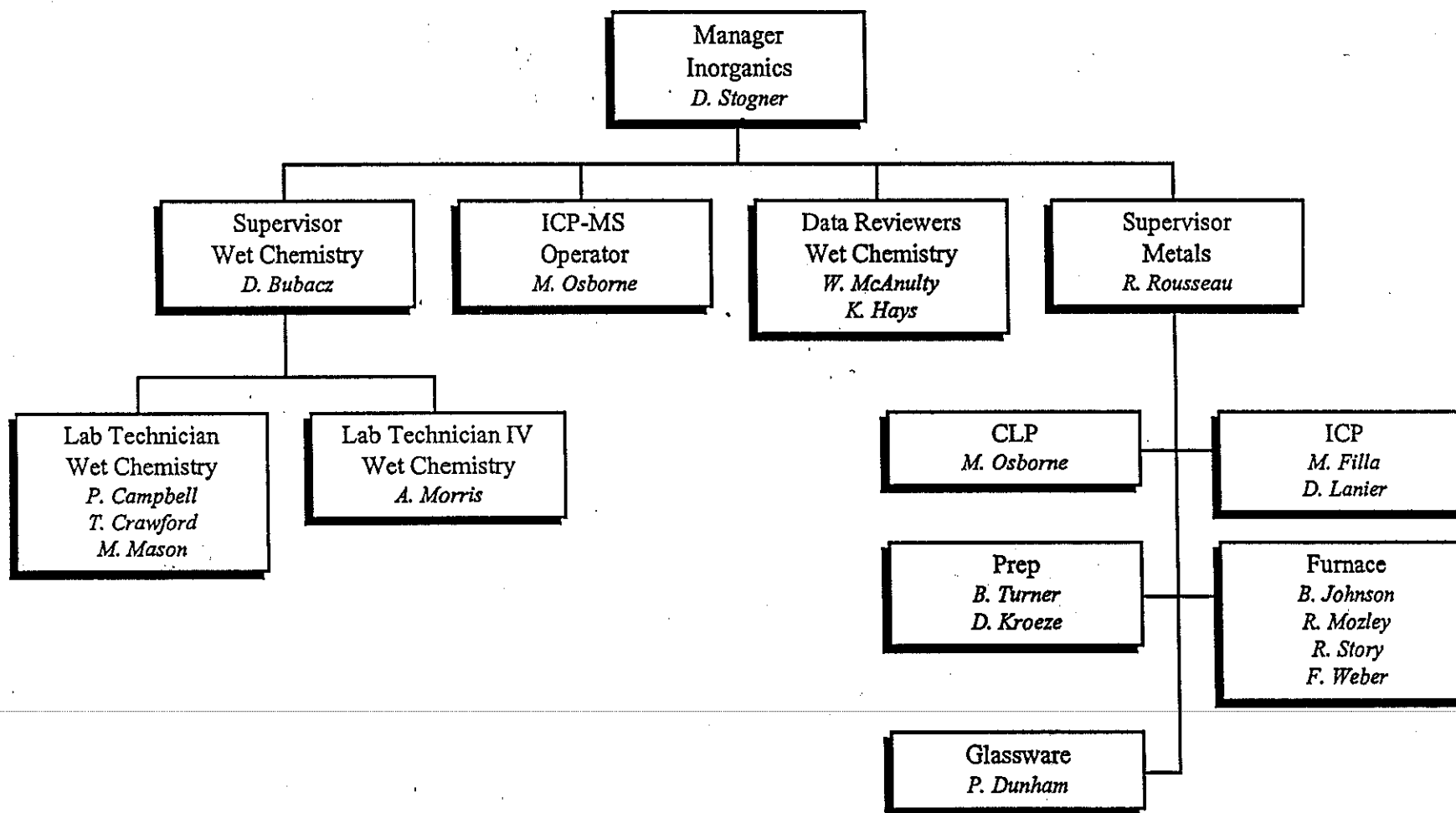
IEA - North Carolina Sample Management



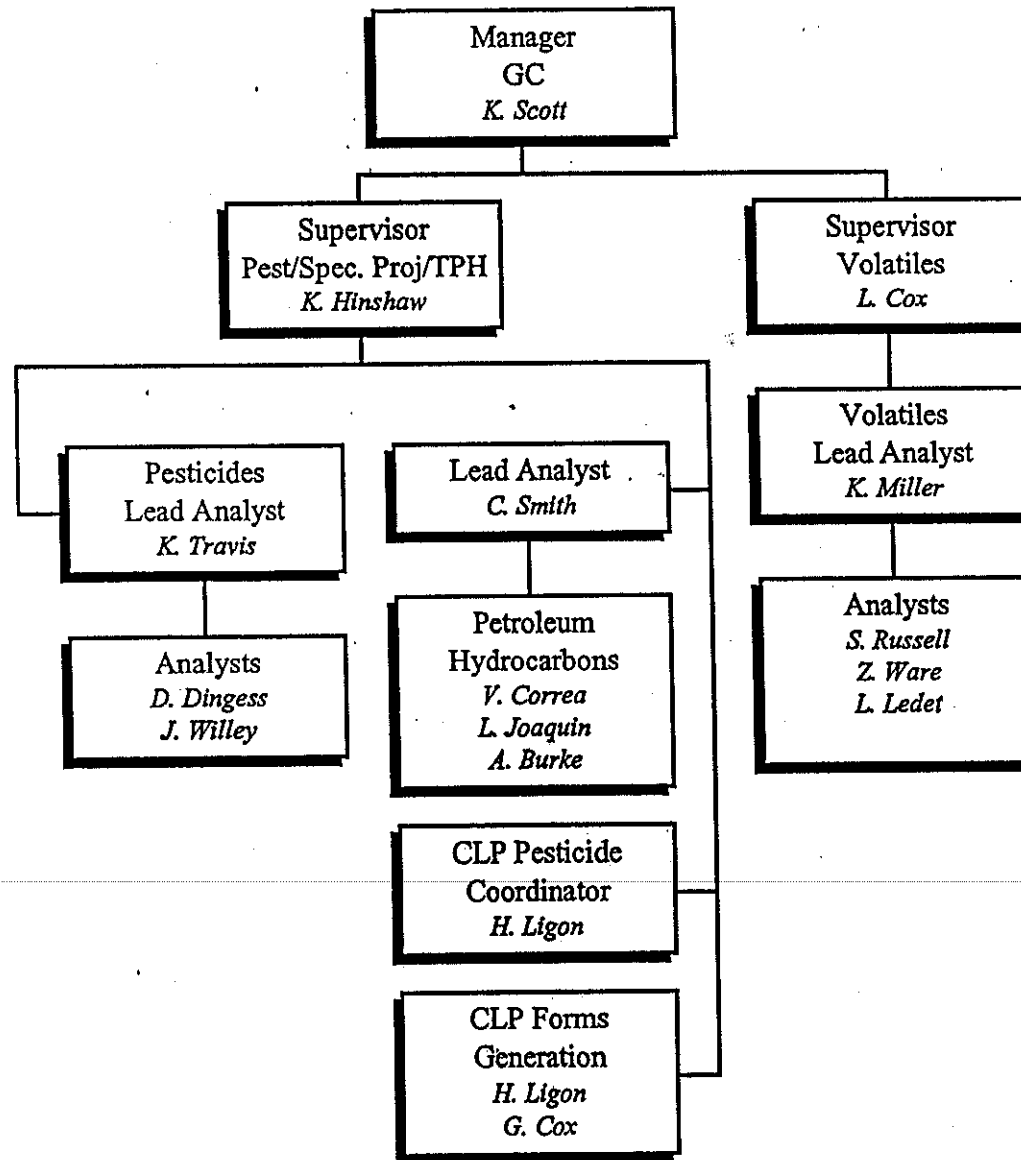
IEA - North Carolina
Sample Preparation



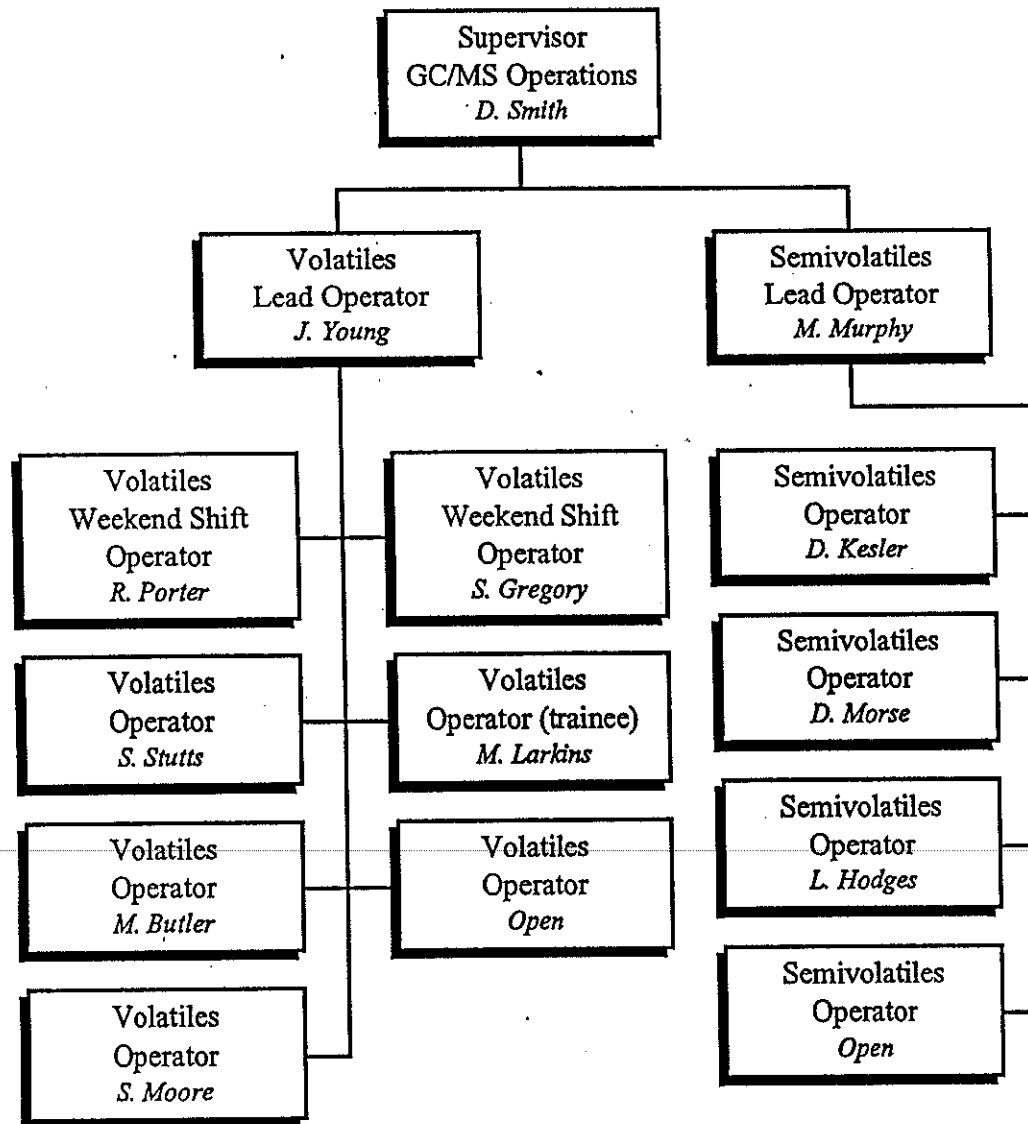
IEA - North Carolina
Inorganics



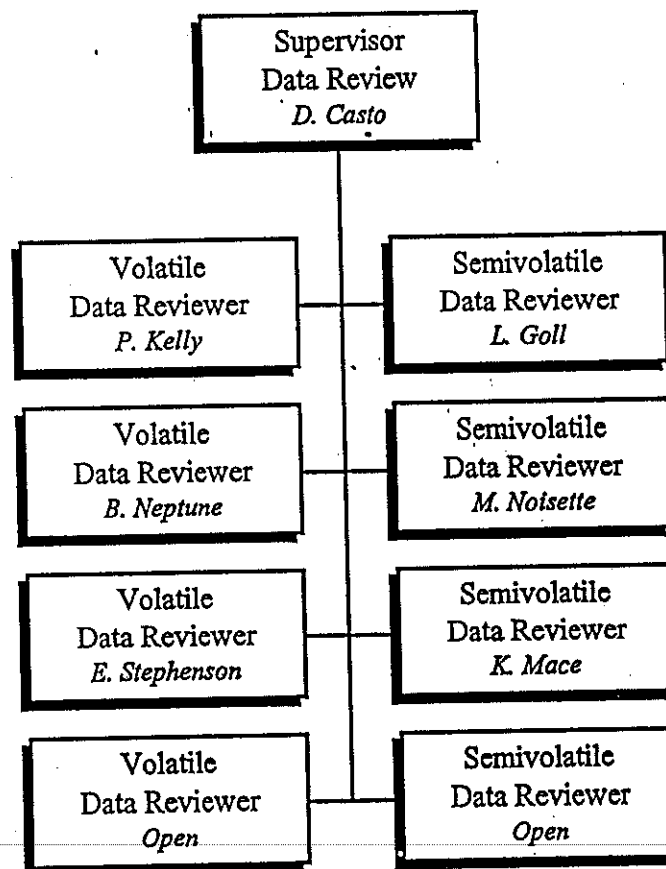
IEA - North Carolina Gas Chromatography



IEA - North Carolina
GC/MS Operations



IEA - North Carolina
GC/MS Data Review



D. Quality Assurance Objectives

The objectives of IEA are to supply precise, accurate data reports to clients which are representative of the sample supplied. All data reported are generated and calculated according to published methods which are recognized standards of the environmental laboratory industry. Thus, data reported by IEA are calculated and reported in units which are consistent with data produced by other organizations. IEA strives to ensure that each data report is 100% complete, containing all data elements and supporting documentation for the type of report requested by the client.

The precision and accuracy control limits employed by IEA are based primarily on limits contained in the published methods or required by the U.S. Environmental Protection Agency's Contract Laboratory Program (CLP). When warranted by IEA's historical data, more restrictive control limits are set than those cited by the method or the CLP.

When the CLP protocol is not applicable to analysis of samples, the precision and accuracy requirements for each analytical method are included in the individual laboratory Standard Operating Procedures (SOP's). A standard format has been defined in IEA Document #QAS00200.NET and implemented for all IEA-North Carolina SOP's. A copy of this and all facility SOP's are available for review during a site visit.

SOP's are used throughout the laboratory to document the proper performance of various activities. All SOP's are document controlled to ensure outdated documents are not utilized. Our document control procedure is detailed in Corporate Document #QAS00100.NET. A copy of this document is available for review during a site visit. At a minimum, IEA-North Carolina is required to have SOP's on file and in use for the following operations:

REQUIRED IEA - NORTH CAROLINA SOP'S

- Sample Receipt and Logging
- Chain-of-Custody Procedures
 - Sample Storage
- Security of Samples and Laboratory Facility
 - Preventing Sample Contamination
- Purity of Standards and Standards Preparation Documentation
 - Maintaining Laboratory Records and Logbooks
 - Sample Analysis and Data Control Systems
- Sample Bottle and Glassware Cleaning Procedures
- Monitoring of Refrigerators, Freezers, and Ovens
- Monitoring of Laboratory Reagent Water Quality
 - Technical Review of Data and Reports
- Sample Analysis, Data Handling and Reporting
 - Instrument Preventative Maintenance
 - Document Control System
 - Corrective Action Process

In addition to the above, there are numerous policies and standard procedures which have been implemented to ensure that data of known quality is continually generated by the laboratory. It is IEA-North Carolina policy to participate in EPA Water Supply (WS) and Water Pollution (WP) proficiency programs. Each program consists of the issuance of proficiency samples twice in a calendar year. Analysis of proficiency samples on the second set of samples in a year is only required by EPA for those parameters which the laboratory failed during the first round in a given year. As part of IEA's Corporate Quality Assurance program, full participation and analysis of all appropriate parameters is required of all IEA laboratories regardless of past performance. This serves as an important indicator on the continuing quality of data being generated at each facility.

E. Sample Custody

Due to the critical nature of the samples analyzed, IEA maintains strict security within the laboratory. Entrances to the laboratory are secured through the use of an electronic card access system. Visitors to IEA must enter through the lobby and sign in at the reception desk. Visitors to the office and/or laboratory must be accompanied by an employee at all times.

Samples are received in the shipping receiving department by the sample custodian or by an authorized member of the department. Upon receipt, the shipping container and the individual sample containers are inspected for damage. If any damage is present, a note is made in the project file, and the project manager or customer service department is notified. All sample information supplied by the client is reviewed and checked against the samples received. The number and type of samples received and the identity tags/labels are checked against the information supplied.

Each sample is assigned an IEA sample number. The IEA sample number is a combination of the IEA Client Number, IEA Client Project Number and the Sample Sequence Number.

Example: Sample number 789-100-2 refers to the second sample in the one hundredth project submitted by IEA client 789.

Each container is labelled with the assigned IEA sample number. If multiple containers are received for a single sample a unique alpha character is added to the end of the sample number assigned to each container. This practice allows each analysis to be traced to a single container.

Each sample received is listed in the IEA Sample Check-In Log with the IEA sample number, client ID number, a complete description of each sample received, sample condition at the time of receipt, date of receipt, sample numbers or identifiers and any problems encountered in the course of receiving the samples. The receipt of chain-of-custody records (Attachment I/Section E) with the sample shipment is also noted on the check-in log.

A Project Data Sheet (Attachment 2/Section E) is completed for each set of samples received. This form serves as the primary source of information for the laboratory. The number and type of samples and sample containers received for the project are listed on the Project Data Sheet as well as type of analysis required, type of report required, turn around time and degree of chain-of-custody documentation required.

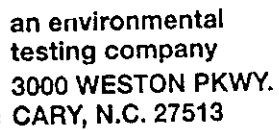
In-lab chain-of-custody records (Attachment 3/Section E) are maintained for each sample when requested by the client. For these samples, the in-lab chain-of-custody record is initiated upon sample receipt. Each movement of a sample or sample extract container into and out of the locked refrigerator system is recorded with date, time, bottle number, action (check in or check out), and signature of the individual accepting or relinquishing responsibility of the sample. The chain-of-custody records are kept in the associated project folder.

After receipt, samples are housed in lockable refrigerators. Refrigerator temperatures are monitored and recorded daily with NIST-traceable thermometers. Samples are removed from the refrigerators by authorized employees for analysis and returned to the locked refrigerator system after completion of the analysis. Throughout the analytical process, each sample is either in the possession of authorized laboratory personnel or secured in a lockable refrigerator inside the secured laboratory area.

Analytical data reports are kept in filing cabinets which are locked at the end of each business day. Sensitive documents are shredded prior to disposal.

In situations where IEA is requested to send sample containers out of our facility, we use a cooler known as a Transpak. This is a corrugated cardboard box lined with an insulated insert. Foam packaging in the inserts preclude container movement and breakage as the holes are cut specifically for protocol-required containers. These Transpaks come in several sizes, and they can be requested by contacting the Client Services Department of IEA - North Carolina. Sampler instructions (Attachment 4/Section E) are included with each Transpak.

Attachment 1 / Section E



REGULATORY CLASSIFICATION - PLEASE SPECIFY

☐ NPDES ☐ DRINKING WATER ☐ RCRA ☐ OTHER

NO: 25800

[illegible]

Attachment 2 / Section E



DATA FOR PROJECT NO.

[illegible]

ATRIX: _____ CUSTOMER SIGNATURE: _____

COMPLETION _____ INITIAL REVIEW _____ DATE SHIPPED _____
(Initials) Date *(Initials)* Date *(Initials)* Date

3 samples received after 2:00 pm will be assigned the date of the following workday.
 _____ represents the date that results are shipped to the customer.

Attachment 3 / Section E

Attachment 4 / Section E

ATTENTION!

SAMPLE INSTRUCTIONS

PLEASE FILL EVERY BOTTLE PROVIDED. IF THIS IS NOT POSSIBLE, IMMEDIATELY CONTACT IEA'S CLIENT SERVICES DEPARTMENT AT (919) 677-0090 IN ORDER TO AVOID UNNECESSARY DELAYS IN ANALYSIS.

ALL SAMPLES SHOULD BE RECEIVED WITHIN 24 HOURS OF SAMPLING. SAMPLES RECEIVED AFTER 24 HOURS FROM SAMPLING MAY REQUIRE ACCELERATED TURNAROUND IN ORDER TO MEET PROTOCOL HOLDING TIME REQUIREMENTS.

PLEASE RETURN COOLANT PACKS WITH THE
TRANSPAK.

SAMPLER INSTRUCTIONS

This sample package has been prepared for you with the objective of helping to maintain the integrity of your samples. It is therefore vital that you read and follow these instructions.

1. Carefully open the sample package and check the contents. If any bottles are missing, broken, or damaged, call the laboratory immediately at 919-677-0090.
2. Remove and freeze the freezer packs included with the shipping container for at least eight hours. They must be solidly frozen upon packing the samples for return shipment. The freezer packs will maintain a sufficiently cool temperature for approximately 72 hours.

3. Note the following before sampling:

- 3.1 40ml Volatile Vials

40ml volatile vials must not contain any air bubbles. Fill the vial to just below the point of overflow, until there is a convex meniscus (see picture at the left). Carefully slide the teflon insert over the meniscus, teflon (stiff) side down (against the sample). Screw the cap on the vial, and check for air bubbles. If air bubbles are present, repeat the capping procedure, or draw another sample, if necessary. Volatile bottles do not normally contain preservative chemicals.

- 3.2 Bacteria Sampling Bottles

Handle sterile bacteria sampling bottles carefully to avoid contamination. Do not open the bottles until ready to sample. Fill to within half an inch of the top, and tighten the cap securely.

3.3 Other Sampling Bottles

Some sample bottles contain strong acids or bases as preservatives. These bottles have color coded cautionary labels. Handle with care. Do not pre-rinse or overfill bottles having color coded cautionary labels. Tighten cap securely when filled. The color code used is as follows:

Red:	Preserved with nitric acid
Yellow:	Preserved with sulfuric acid
Blue:	Preserved with hydrochloric acid
White:	No preservative
Green:	Preserved with sodium hydroxide (basic) solution

4. Complete the sample tags and labels by filling in the sample I.D., sampling address, the sampling point, date and time (24 hr. format; for example: 8:00 am = 0800 hours or 10:00 pm = 2100 hours). Indicate if the sample is a grab or composite. The sampler should initial at the appropriate space.
5. Make sure all caps are secure, and attach labels and tags to correct bottles. Repack the samples for return shipment to the laboratory, making sure to include the freezer packs. Ship by a route which will ensure delivery within 72 hours.
6. If you have any questions, call IEA's sample receiving department, or our client representative, at 919-677-0090 between 8:00 am and 5:00 pm Monday through Friday.

F. Instrument Calibration

Because of the critical relationship between instrument calibration, the accuracy of the analytical data generated, and specific method protocols that determine data quality, IEA maintains strict controls on the calibration procedures for the various types of analytical equipment. Each type of instrumentation is calibrated prior to sample analysis according to method criteria. Specific criteria for the instrument calibrations must be met before samples may be processed. Corrective action must be taken to remedy any out of control situations. Deviations from the stated criteria are strictly forbidden.

Hardcopy records of all instrument calibrations are maintained in the individual laboratories. These records are reviewed by the department managers and/or supervisors and are audited semi-annually by the local Quality Assurance Manager and semi-annually by the Corporate Director of Quality Assurance.

G. Analytical Procedures

The analytical methods employed by IEA for the analysis of environmental samples include methods published in the following: Tests for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, USEPA 3rd Edition, 1986; Federal Register, 40, CFR, Part 136, volume 49, No. 209, October 26, 1984; Standard Methods for the Examination of Water and Wastewater, 16th Edition, 1985; Methods for Chemical Analysis of Water and Wastes, EPA 600/4-79-20, 1979, (revised 1983). Methods selected for use by the USEPA Contract Laboratory Program (CLP) and published in the statement of work for each contract are also utilized by IEA.

Attachment A presents a listing of methods employed by IEA Laboratories, Cary, North Carolina when Drinking Water is analyzed for compliance with the State of North Carolina Drinking Water Program.

Each data report issued by IEA includes a reference to the exact method employed for the analysis. The referenced methods are strictly adhered to by the laboratory. Occasionally, modifications of the referenced method are necessary. All deviations from the published method must be approved by both the Quality Assurance Manager and the Laboratory Director and are stated in the final report with the reason(s) for the deviation. Deviations and discrepancies are documented using the "Client Project Discrepancy Report" form (Attachment I/Section G).

Attachment 1 / Section G

CLIENT PROJECT DISCREPANCY REPORT

Project No. _____ Client: _____ Phone No. () _____
Project Manager: _____

Discrepancy:

- 1.
- 2.
- 3.
- 4.

Samples Received: 1) Out of Protocol Yes No
 2) *Chilled Yes No
 3) Other Yes No

Comments:

Initiated By: _____ Date: __/__/__ Time: __:__
* Not Required for Metals

Resolution:

- 1.
- 2.
- 3.
- 4.

Client Contacted	Yes	No	Date: __/__/__
Analyze Samples	Yes	No	Time: __:__
Will Resample	Yes	No	Day Zero: _____
Send Transpak	Yes	No	

Resolved By: _____ Date: __/__/__ Time: __:__

H. Laboratory Quality Control Checks

The analytical process is continually checked and verified through the analysis of method blanks, instrument blanks, matrix spikes, duplicate matrix spikes and sample duplicates. The department supervisor is responsible for the administration of the quality control checks within each department. The records associated with the administration of the quality control checks are reviewed quarterly as part of the system and performance audits conducted by the Quality Assurance Manager. The data generated for each quality control sample are reviewed by the department supervisor, Laboratory Director, and a member of the senior technical staff as part of the normal data review process.

All analytes are required to have concentrations of less than the Practical Quantitation Limit (PQL) in all method and instrument blanks. Analysis of samples should not proceed until this requirement is met. Noncompliance with respect to system blanks would result in data qualification, and this would be documented in the report to the client.

Matrix spike duplicates are prepared and analyzed for all organic analyses at a rate of one pair for every twenty (20) samples. The data generated for each pair of matrix spike duplicates are used to measure the precision and accuracy of the analysis. A blank spike containing all analytes is also prepared with each pair of duplicate matrix spikes. If the precision or accuracy of the duplicate spikes is outside the control limits, the blank spike must be analyzed. The analysis of the blank spike is evaluated to determine if the analytical failure was caused by to the sample matrix or by the laboratory analyst. Acceptance criteria for the matrix spike duplicate pairs analyzed for the common organic analyses are listed in Tables H-1 and H-2 of this section.

Surrogate compounds are routinely used for the organic analyses. Compounds similar to the analytes of interest are added to each sample prior to initiation of the analytical process. The recovery of the surrogate(s) in the final analysis is used to evaluate the accuracy and precision of the process in each sample. Acceptable surrogate data must be obtained for each

set of reported sample data. A database of surrogate recovery data for all samples is maintained. This database is reviewed at least once a month by the department supervisor. The Quality Assurance Manager evaluates the surrogate recovery data quarterly.

Current surrogate control limits for the common organic analyses are listed in Table H-3 on page 37 of this QA Program Plan. -

Internal standards are employed for all GC/MS analyses. The internal standard areas are evaluated periodically to ensure the consistency of the injection techniques used throughout the laboratory.

Duplicate sample analyses are performed for the metals and inorganic parameters at a rate of one duplicate for every ten sample analyses. Warning and control limits have been established for each parameter. The specific limits have been included in the individual SOP's. Typical limits for the metals analyses are:

<u>Relative Percent Difference (RPD)</u>	
Analyte Concentration Range	Warning Limit Control
Limit	
0.03 - 0.20 mg/L	35 %
0.21 - 2.00 mg/L	15 % 65 % 20 %

Spiked sample analyses are performed for the metals and inorganic parameters at a rate of one spike for every ten sample analyses. Warning and control limits have been established for each parameter. The specific limits have been included in the individual SOPs. Typical limits for metals analyses are:

Analyte Concentration Range	Warning Limit % Recovery	Control Limit % Recovery
0.03 - 0.20 mg/L	± 25 %	± 40 %
0.21 - 2.00 mg/L	± 15 %	± 20 %

Table H-1: Spike Acceptance Criteria for Common Organic Analyses in Water

Semivolatiles by GC/MS

	<u>% Recovery</u>	<u>RPD</u>
BN 1,2,4-Trichlorobenzene	39 - 98	28
BN 1,4-Dichlorobenzene	36 - 97	28
BN N-nitroso-di-n-propylamine	41 - 116	38
BN Acenaphthalene	46 - 118	31
BN 2,4-Dinitrotoluene	24 - 96	38
BN Pyrene	26 - 127	31
A Phenol	12 - 110	42
A 2-Chlorophenol	27 - 123	40
A 4-Chloro-3-methylphenol	23 - 97	42
A 4-Nitrophenol	10 - 80	50
A Pentachlorophenol	9 - 103	50

For acceptance, the majority of % recoveries and RPDs for each compound class (acid or base-neutral) in the duplicate spike pair must meet the % recoveries and RPDs listed above.

Volatiles by GC/MS

	<u>% Recovery</u>	<u>RPD</u>
1,1-Dichloroethane	61-145	14
Trichloroethene	71-120	14
Benzene	76-127	11
Toluene	76-125	13
Chlorobenzene	75-130	13

For acceptance, the majority of % recoveries and RPDs obtained for the duplicate spike pair must meet the % recoveries and RPDs listed above.

Pesticides by GC

	<u>% Recovery</u>	<u>RPD</u>
Lindane	56 - 123	15
Heptachlor	40 - 131	20
Aldrin	40 - 120	22
Dieldrin	52 - 126	18
Endrin	56 - 121	21
4,4'-DDT	38 - 127	27

For acceptance, the majority of % recoveries and RPDs obtained for the duplicate spike pair must meet the % recoveries and RPDs listed above.

Table H-2: Spike Acceptance Criteria for Common Organic Analyses in Soil

Semivolatiles by GC/MS

	<u>% Recovery</u>	<u>RPD</u>
BN 1,2,4-Trichlorobenzene	38 - 107	23
BN 1,4-Dichlorobenzene	28 - 104	27
BN N-nitroso-di-n-propylamine	41 - 126	38
BN Acenaphthalene	31 - 137	19
BN 2,4-Dinitrotoluene	28 - 89	47
BN Pyrene	35 - 142	36
A Phenol	26 - 90	35
A 2-Chlorophenol	25 - 102	50
A 4-Chloro-3-methylphenol	26 - 103	33
A 4-Nitrophenol	11 - 114	50
A Pentachlorophenol	17 - 109	47

For acceptance, the majority of % recoveries and RPDs for each compound class (acid or base-neutral) in the duplicate spike pair must meet the % recoveries and RPDs listed above.

Volatiles by GC/MS

	<u>% Recovery</u>	<u>RPD</u>
1,1-Dichloroethane	59 - 172	22
Trichloroethane	62 - 137	24
Benzene	66 - 142	21
Toluene	59 - 139	21
Chlorobenzene	60 - 133	21

For acceptance, the majority of % recoveries and RPDs obtained for the duplicate spike pair must meet the % recoveries and RPDs listed above.

Pesticides by GC

	<u>% Recovery</u>	<u>RPD</u>
Lindane	46 - 127	50
Heptachlor	35 - 130	31
Aldrin	34 - 132	43
Dieldrin	31 - 134	38
Endrin	42 - 139	45
4,4'-DDT	23 - 134	50

For acceptance, the majority of % recoveries and RPDs obtained for the duplicate spike pair must meet the % recoveries and RPDs listed above.

Table H-3: Surrogate Control Limits

Semivolatiles by GC/MS

	----- % Recovery -----	
	<u>Water</u>	<u>Soil</u>
Nitrobenzene-d5	35 - 114	23 - 123
2-Fluorobiphenyl	43 - 116	30 - 115
Terphenyl-d14	33 - 141	18 - 137
Phenol-d6	10 - 94	24 - 113
2-Fluorophenol	21 - 100	25 - 121
2,4,6-Tribromophenol	10 - 123	19 - 122
2-Chlorophenol-d4	33 - 110*	20 - 130*
1,2-Dichlorobenzene-d4	16 - 110*	20 - 130*

Volatiles by GC/MS

	----- % Recovery -----	
	<u>Water</u>	<u>Soil</u>
Toluene-d8	88 - 110	81 - 117
Bromofluorobenzene	86 - 115	74 - 121
1,2-Dichloroethane	76 - 114	70 - 121

Pesticides by GC

	----- % Recovery -----	
	<u>Water</u>	<u>Soil</u>
Tetrachloro-m-xylene	60 - 150*	60 - 150*
Decachlorobiphenyl	60 - 150*	60 - 150*

*These control limits serve as warning limits not control limits per CLP. All other limits are control limits.

I. Data Reduction and Reporting

The data associated with each analysis are hardcopied for permanent storage either through the printing of computer files or through hand entry into bound laboratory notebooks. All notebook entries are dated and signed by the analyst. Standardized notebook and logbook requirements include the following:

- (01) Preprinted pages
- (02) Prenumbered pages
- (03) Bound logbooks
- (04) Document controlling of logbooks
- (05) Archival of old logbooks
- (06) Acceptance criteria in logbook
- (07) Making corrections
- (08) Secondary review of logbook entries

Notebook entries, or any other general laboratory records, must be made in blank ink. Any logbook or notebook entries that are corrected are made by using a one-line strikeout in black ink. All corrections are signed and dated.

Data reduction includes all processes that change either the form of expression (i.e., the units of measure) or the quantity of data values (rounding). It often involves statistical and mathematical analysis of data and usually results in a reduced subset of the original data set. Data reduction is performed either manually by the analyst or by computer systems interfaced to the analytical instruments. Whenever such procedures are employed within the laboratory Network, mathematical procedures have been verified for accuracy of computation.

All data are subjected to a multilevel review. All data reports are reviewed by the department supervisor prior to release for final report generation. A cross section of data

reports are reviewed by the Laboratory Director. All final data reports are reviewed by a member of the senior technical staff prior to release to the client. It is the responsibility of the Quality Assurance Manager to review a random sample of five percent of final reports prior to shipment. The members of the senior technical staff and Quality Assurance are not members of the analytical production laboratories.

Out-of-control conditions identified by the analyst, supervisor, manager or technical staff member are investigated, corrected and documented. Out-of-control conditions which are caused by the sample itself, are addressed in a project narrative in the final report.

All elements of the IEA-North Carolina Quality Assurance Program must be satisfied before a data report may be released to the client.

J. Performance and System Audits

Each quarter the overall performance of the laboratory staff is evaluated and compared to the performance criteria outlined in the quality assurance manual and the standard operating procedures. The local Quality Assurance Manager conducts a laboratory audit semi-annually to evaluate the performance of the laboratory staff and compares that performance to the requirements of the quality assurance program. The Corporate Director of Quality Assurance also conducts semi-annual system audits to provide the quarterly audit frequency. During this process, the records, standard operating procedures and adherence to those standard operating procedures are examined. The results of the audit process are summarized and issued to each department supervisor and the Laboratory Director.

Known intralaboratory performance samples are analyzed in the form of sample spikes, duplicates and duplicate sample spikes on a continuing basis. Two (2) such samples are processed for every twenty (20) production samples.

IEA participates in interlaboratory performance audits through the various state and federal certification programs. IEA is an active participant in the U.S. Environmental Protection Agency's Contract Laboratory Program (CLP) and the U.S. Army Corps of Engineers accreditation program. A list of IEA-North Carolina certifications, as well as those for our other six network laboratory operations, summarizes our analytical capabilities (Attachment I/Section I).

Attachment 1 / Section J

STATE CERTIFICATIONS

Certifying State	Program Type	NC	MA	VT	FL	CT	NJ	IL
Alabama	DW	Y						
Arkansas	None	-	-	-	-	-	-	-
Connecticut	General					Y	Y	Y
California	DW	Y						
	WW							
	HW	Y						
Florida	DW	Y			Y			
	WW				Y			
	DW							Y
Georgia	DW	Y						
Illinois	DW							
Kansas	DW	Y						
	HW	Y						
Kentucky	DW	Y						
Louisiana	None	-	-	-	-	-	-	-
Maine	DW		Y	Y				
Massachusetts	DW	Y	Y	Y		Y		
	WW	Y	Y			Y		
Minnesota								
Missouri								
New Hampshire	DW		Y					
	WW		Y					
	DW	Y				Y	Y	
New Jersey	WW	Y				Y	Y	
	DW					Y	Y	
	WW					Y	Y	
New York	DW							
	WW					Y	Y	
	HW					Y	Y	
North Carolina	DW	Y						
	WW	Y	Y					
	DW						Y	
Pennsylvania	DW						Y	
Rhode Island	None	-	-	-	-	-	-	-
South Carolina	DW	Y					Y	
	WW	Y					Y	
	DW	Y					Y	
Tennessee	General							
Texas	DW			Y				
Vermont	DW	Y						
Virginia	WW	Y						
West Virginia	DW	Y						
Wisconsin	General							Y

Footnotes:

- DW -Drinking Water certification program
- WW -Wastewater certification program
- HW -Hazardous Waste certification program
- Y -Laboratory has some form of certification under the specific program.
- None -No program currently exists in this State, therefore, certification is not available.

K. Preventive Maintenance

Schedules of required maintenance have been prepared for each analytical instrument. By scheduling routine preventive maintenance, instrument downtime is minimized with regard to critical analytical schedules. All repair work is recorded in instrument maintenance logs with the date, reason for the repair, action taken and name of the repair person.

Laboratory maintenance schedules for key instrumentation are summarized below:

GC/MS

Extrel Instruments

1. Change septa
2. Change disc drive filter
3. Change mechanical pump oil
4. Grease turbo pumps
5. Change column
6. Change injection port liner

Frequency

as needed
quarterly
quarterly
quarterly
as needed
as needed

Hewlett-Packard Instruments

1. Change septa
2. Change card cage filter
3. Change disk drive filter
4. Change mechanical pump oil
5. Change turbo pump oil
6. Change traps
7. Change columns
8. Change injection port liners

Frequency

as needed
quarterly
quarterly
quarterly
annually
as needed
as needed
as needed

GC

1. Change septa
2. Change injection port liners
3. Change column
4. Wipe test ECD's (not Tracor)
5. Wipe test ECD's (Tracor)
6. Check gas cylinders

Frequency

as needed
as needed
as needed
semiannually
3 years
daily

ICP

1. Check air and nitrogen tanks
2. Check level in waste jug
3. Clean nebulizer tips
4. Rinse spray chamber
5. Check drain tubing for air bubbles
6. Clean torch assembly
7. Check purge extension windows
8. Clean purge extension windows
9. Change vacuum pump intake trap
10. Change vacuum pump oil
11. Clean computer ventilation slits

Frequency

daily
daily
as needed
as needed
as needed
as needed
monthly
as needed
1000 hrs.
1000 hrs.
semiannually

AA

1. Check dials, panel lights and control knobs for proper functioning
2. Check energy of deuterium background corrector
3. Note AA lamp output
4. Check gas and water lines for leaks
5. Check graphite tube condition
6. Clean electrodes on furnace
7. Change electrodes on furnace

Frequency

daily
daily
daily
as needed
daily
as needed
as needed

TOC AnalyzerFrequency

- | | | |
|----|---|-----------|
| 1. | Sweep pyrolysis tube, check humidifier water level, check gas supplies, check furnace temperature, change injection port system, balance the totalizer. | as needed |
| 2. | Clean sample boat and push rod | as needed |
| 3. | Run system performance tests, lubricate piston shaft, change septum, clean inlet tube | as needed |

General Laboratory AreasFrequency

- | | | |
|----|--|-----------|
| 1. | Clean laboratory | weekly |
| 2. | Check supply of consumable items | weekly |
| 3. | Inspect, clean and replace worn parts on automatic pipets. | as needed |
| 4. | Calibrate automatic pipets. | monthly |
| 5. | Calibrate thermometers | annually |
| 6. | Record oven refrigerator temperatures | daily |
| 7. | Check fume hood air flow | monthly |
| 8. | Calibrate balances | annually |

I. Specific Quality Control Procedures for Data Quality Assessment

Data quality is assessed based on five main characteristics of the data which are:

Precision
Accuracy
Completeness
Representativeness
Comparability

Each of these characteristics is discussed below.

Precision

Precision is a measure of the reproducibility among replicate analyses. Data acceptance during normal processing is based on the specific control limits for the common analyses which are listed in Section G - Laboratory Quality Control Checks, and are more completely described in the analytical method Standard Operating Procedures. Data obtained for all duplicates are evaluated monthly by the Quality Assurance Manager for developing trends. Relative Percent Difference (RPD) is used as the measure of precision between matrix spike duplicates. The formula utilized to calculate RPD is as follows:

Relative Percent Difference (RPD)

$$RPD = \frac{(MS - MSD)}{\text{Mean of MS} + MSD} \times 100$$

where

MS = Percent Recovery for Matrix Spike

MSD = Percent Recovery for Matrix Spike
Duplicate

Accuracy

Accuracy is a measure of the degree of difference between the analytically obtained value and the known or actual value for a sample. IEA assesses accuracy by determining the percent recovery (%R) for analytes contained by designated quality

control samples. Acceptance criteria for spiked samples processed by the laboratory are listed in Section G - Laboratory Quality Control Checks. Acceptance criteria for other specific methods may be found in the analytical Standard Operating Procedures. Data obtained for all laboratory spikes are evaluated monthly by the Quality Assurance Manager for developing trends.

$$\text{Percent Recovery} = \frac{\text{Analytical Value}}{\text{Spiked Value}} \times 100$$

Completeness

Completeness is a measure of the valid data obtained from an analysis expressed as the percentage of the total data that should have been obtained.

$$\% \text{ Completeness} = \frac{\text{Amount of Valid Data Obtained}}{\text{Total Amount of Valid Data Expected}} \times 100$$

IEA's objective for completeness is to be able to provide analytical data for 100% of samples received intact and have sufficient sample volume for conducting reanalysis if initial analysis does not meet QC acceptance criteria.

Representativeness

Representativeness of the analytical data is primarily a function of the sampling procedures and techniques employed in the field. As such, the sampling plan must be designed to provide representative samples to the laboratory. Once received at the laboratory, samples are homogenized as much as possible to yield representative data on the sample submitted for analysis.

Comparability:

The IEA objective for comparability is that all data be fully comparable with data from other Network laboratories. This is accomplished through use of the following practices:

- * Demonstrate traceability of standards to NIST or EPA sources.
- * Use of Standard and Approved methodologies
- * Standardized units of measure.
- * Standardized QC Acceptance Criteria.
- * Participation in interlaboratory studies to demonstrate laboratory performance.

M. Corrective Action

Corrective actions can be initiated at several operational levels; however, they always involve QA personnel. In each case, after an assessment of the situation, appropriate steps are taken to correct the problem. Depending on the severity of the problem, corrective actions may be taken at the analyst level, department level, or within the entire laboratory. IEA recognizes the importance of corrective action to maintain a high quality program. In this light, all data are reviewed for completeness, accuracy, and compliance with QC criteria both within the analytical laboratory by peer review and by the department supervisor or manager.

In general, there are three major types of corrective actions which may be initiated at IEA:

Sample Problems

Individual samples or matrix problems are usually handled within the analytical laboratory. Corrective actions may include complete reextraction, repreparation, analysis, clean-up, dilutions or matrix modifications. All actions taken are documented with the analytical results.

QC Batch Problems

An entire batch of samples may require corrective action if QC criteria are not met. Department managers and QA staff are involved in the decisions for actions which include reanalysis, reextraction, etc. The QA department personnel review both sets of data where applicable to determine if the problems have been resolved.

Systematic Problems

Those problems of a procedural nature are handled by the laboratory managers and QA manager. For major operational changes, initiation of such are made only after approval by the QA manager and the Laboratory Director.

The corrective action process at IEA-North Carolina is described in detail in an SOP (Doc.# QAS00600.NC) and is available for review during a site visit.

N. Quality Assurance Reports to Management

IEA Corporation's Quality Assurance department consists of a Quality Assurance Manager at each of the seven network laboratories. The laboratory Quality Assurance Manager reports directly to the Director of Operations for that facility and indirectly to the Corporate Director of Quality Assurance.

The Quality Assurance department communicates internally and externally through various means. Communication can take place via telephone, memoranda, or take the form of audit reports. At the present time, the Quality Assurance department participates in a weekly conference call to discuss relevant issues and disseminate information.

In addition, routine Quality Assurance reports are generated. Each Quality Assurance Manager prepares a monthly QA report for Corporate QA.

Semi-annual system audits are performed by each Quality Assurance Manager according to a Corporate audit checklist. A copy of the audit report is distributed to both the Corporate QA Director and the facility Director of Operations. A summary of these reports are prepared each month by the Corporate QA Director and are submitted to upper management. A typical status report would include such information as:

- * changes in the quality assurance program
- * summary of proficiency results at each network laboratory
- * changes in certification status
- * summary of system audits conducted at each network laboratory
- * accomplishments since the previous report

The Quality Assurance program can only accomplish it's objectives if management and staff are committed to adherence to the program. In order to assess continued compliance and to identify strong and weak points of the program, the Network QA Director conducts semi-annual assessments at each location.

ATTACHMENT A -Continued...

Summary of Drinking Water Methodologies utilized at IEA Laboratories, Cary, North Carolina

METHOD REFERENCES #20

- A- "Methods of Chemical Analysis of Water and Wastes", EPA Environmental Monitoring and Support Laboratory, Cincinnati, Ohio 45268 (EPA-800/4-79-020), March 1979.
- B- "Standard Methods for the Examination of Water and Wastewater", 14th Edition, American Public Health Association, American Water Works Association, Water Pollution Control Federation, 1975.
- C- "The Analysis of Trihalomethanes in Drinking Water by Liquid/Liquid Extraction", Method 601.2, BWSL, EPA, Cincinnati, Ohio 45268.
- D- "Methods for the Determination of Organic Compounds in Drinking Water", EPA Environmental Monitoring Systems Laboratory, Cincinnati, Ohio 45268 (EPA/800/4-89/039), Dec. 1989.

FOOTNOTES

- 1- Standard curve is composed, at a minimum, of a reagent blank and 3 standards. The curve is verified each day that analyses are performed using a blank and a reference standard. Acceptance criteria is $\pm 10\%$ of the original curve. If more than 20 samples are analyzed in a day, a standard is run every 20 samples and must meet the same acceptance criteria.
- 2- RCP Instruments are calibrated daily using an initial calibration blank (CB) and one high level standard. The calibration is verified using an initial calibration verification solution (CV). This solution contains elements from an independent source not used for the calibration standards. Analyses are within the range of the calibration curve. Acceptance criteria is met when the analysis is within 90-110% of the true value except for Hg. Acceptance criteria for Hg is 80-120% of the true value.
- 3- A minimum of 3 calibration standards are analyzed daily. Acceptance criteria for curve is a Correlation Coefficient > 0.997 .
- 4- Ten percent (10%) of all samples are analyzed in duplicate. Acceptance criteria is $\pm 10\%$ RPD. Analysis level must be $> 10\times$ the MDL for criteria to apply.
- 5- One method blank and QC Check is run per batch of samples. Batches cannot exceed 20 samples, therefore 25 samples would be run as 2 batches with 2 method blanks and 2 QC Check samples. Method blank acceptance criteria is below the MDL. QC Check must be within 80-110 percent recovery. A method blank is not appropriate for pH, therefore, it is not performed.
- 6- A continuing calibration blank (CCB) is analyzed at a 10% frequency and a procedure blank (PB) at a 6% frequency. Acceptance criteria is less than the MDL of the method.
- 7- Analysis must be performed within the number of days indicated from the date of sample extraction.
- 8- pH meter is calibrated using 2 buffers, a third buffer is then measured and must be within ± 0.2 pH units. For example, calibrate using 7 and 10, read 4 buffer and check against acceptance criteria.
- 9- Cool 4 days C.
- 10- Concentrated Nitric Acid to a pH of < 2 .
- 11- Concentrated Sulfuric Acid to a pH of < 2 .
- 12- Sodium Ethoxide is added in the presence of residual chlorine.
- 13- 1:1 Hydrophobic acid to a pH of < 2 .
- 14- Containers may be plastic or glass.
- 15- Container must be glass.
- 16- Container must be glass with lidon lined cap.
- 17- Container must be glass with foil lined cap, vial is used with lidon lined cap.
- 18- Glass vials vial is used with lidon lined cap.
- 19- To confirm the lack of interference, a post digestion spike is performed on each matrix for graphite furnace metals. Acceptance criteria is 80-110% recovery.
- 20- It is IEA's intention to use the latest versions of methodologies which have been approved for drinking water analysis as they become available.
- 21- Samples are spiked at a frequency of 10%. Acceptance criteria is $\pm 25\%$ recovery. Metals are spiked after the digestion procedure. For some analyses involving a large number of analyses, a subset subset of analyses are used for spiking purposes.
- 22- Ascorbic Acid (25 mg) is added in the presence of residual chlorine.

The primary objective of IEA is to provide legally and scientifically defensible data to clients in a timely and cost effective manner. The achievement of this goal is dependent upon an active Quality Assurance program. The Quality Assurance Manager is responsible for monitoring laboratory compliance with all elements of the Quality Assurance program and communicating the status of the program to the Corporate QA Director as well as the Director of laboratory operations.

O. Personnel Qualifications

General

All persons hired or assigned to key laboratory positions at IEA work closely with experienced personnel. Their program and performance is closely supervised and evaluated. The principal criterion for employment or assignment is demonstrated professional proficiency at IEA or at previous places of employment.

Laboratory Staff Members

The qualifications of key laboratory staff members are summarized in the appended resumes (Attachment I/Section O). We have developed an organization of technical specialists in all major disciplines of the environmental sciences. Each person is thoroughly trained and experienced in his/her respective filed and qualified to function with other staff members to form an integrated team.

Required educational and experience qualifications of key laboratory personnel are described below:

Laboratory Director

B.S. degree in Chemistry, with a minimum of 10 years of environmental laboratory experience.

Client Services Director:

B.S. degree, with a minimum of 10 years of laboratory experience.

Quality Assurance Manager:

B.S. degree in scientific discipline, with a minimum of 10 years of laboratory experience.

Laboratory Department Supervisors:

Bachelors degree in scientific discipline, with minimum of 3 years of environmental laboratory experience or equivalent.

Technical Reviewer:

B.S. degree in scientific discipline with a minimum of 2 years of environmental laboratory experience.

Attachment 1 / Section O

PROFESSIONAL PROFILE
Richard K. Schmidt

TITLE: President and Chief Executive Officer

ACADEMIC ACCOMPLISHMENTS:

Harvard Business School
Program for Management Development

University of Texas - Austin
Ph.D. Environmental Engineering

Tulane University
M.S. Civil Engineering
B.S. Civil Engineering

SUMMARY OF EXPERIENCE:

Dr. Schmidt has over 20 years of diversified experience relative to the public and private business environment. He has successfully started two companies and has considerable experience managing environmentally related businesses. In addition, Dr. Schmidt has extensive international and acquisition experience.

PROFESSIONAL EXPERIENCE:

1992 to Present IEA-North Carolina, Inc.

Position President and Chief Executive Officer

Responsibilities

Responsible for leading and developing this network of environmental testing laboratories.

1992 to 1984 Mechanical Technology, Inc.
Latham, New York

Position President and Chief Operating Officer

Responsibilities

Chief operating officer for this multi-divisional supplier of technology products and services sold to aerospace, computer and government markets. Revenues were \$90 million annually.

1981 to 1984 Gundle Environmental Systems
Houston, Texas

Position President and Chief Executive Officer

Responsibilities

As Co-founder responsible for subsequent growth of revenues in excess of \$100 million, this now public company has been recognized as one of the most successful start-up companies in the 1980's.

1978 to 1981

The Graver Company
Ecodyne Corporation subsidiary
Union, New Jersey

Position

President

1974 - 1978

Industrial Waste Treatment Division
Ecodyne Corporation subsidiary
Union, New Jersey

Position

Vice President and General Manager

1971 - 1974

Smith and Loveless Division
Ecodyne Corporation subsidiary
Lenexa, Kansas

Position

Director of Development

PROFESSIONAL AFFILIATIONS:

Trustee, Capital Repertory Theater
Director, Chase Lincoln Bank
Director, University of Pittsburgh Engineering Board
Trustee, Siena College Advisory Board

Doe#-HRR09600.NET

PROFESSIONAL PROFILE
David C. Houle

TITLE: Chief Operating Officer

ACADEMIC ACCOMPLISHMENTS:

Worcester Jr. College - Worcester, Massachusetts
A.S. Business
Plymouth State College - Plymouth, New Hampshire
B.S. Business Ed./Administration

PROFESSIONAL EXPERIENCE:

1991 to Present IEA-North Carolina, Inc.

Position Chief Operating Officer

Responsibilities

Responsible for day to day operations of all IEA divisions which includes administration, sales and laboratory operations.

1991 IEA-Connecticut, Inc.

Position Director of Operations

Responsibilities

Responsible for the daily operations of the Connecticut facility. Primary emphasis was placed on administrative and laboratory activities.

1984 to 1991 Timco, Inc.
Center Barnstead, New Hampshire

Position President

Responsibilities

Overall responsibility for all financial and operational matters for a lumber and cogeneration facility, with sales of \$10 million.

1982 to 1984 Timco, Inc.
Center Barnstead, New Hampshire

Position Vice President/Controller

Responsibilities

Overall responsibility for all financial and operational matters.

1975 to 1982 Land East Corporation

Claremont, New Hampshire

Position Controller/General Manager

Responsibilities

Responsible for all financial and operational matters for a \$15 million sales company involved in Real Estate, Land development, lumber and finance company.

1973 to 1975

Special Education Collaborative
North Reading, Massachusetts

Position Business Manager

Responsibilities

Responsible for all financial matters, budget preparation, monitoring, and non professional staff.

1970 to 1973

Newport New Hampshire School District
Newport, New Hampshire

Position Business Manager

Responsibilities

Responsible for all financial matters, budget preparation, monitoring, and non professional staff.

1967 to 1970

Newport New Hampshire School District
Newport, New Hampshire

Position Business Teacher

Responsibilities

Instructed business classes to high school students.

PROFESSIONAL PROFILE
James A. Ploscyca

TITLE: Corporate Director of Quality Assurance

ACADEMIC ACCOMPLISHMENTS:

S.U.N.Y. College at Buffalo
B.A. Biology
-
S.U.N.Y. College at Morrisville
-
A.A.S Environmental Science

MAJOR AREA OF EXPERTISE:

Environmental Quality Assurance
Environmental Laboratory Management
Environmental Chemistry

SUMMARY OF EXPERIENCE:

Mr. Ploscyca has over 15 years of diversified experience relative to the operation of environmental laboratories and the generation and evaluation of environmental data. Previous experience includes the design and management of the Corporate Quality Assurance program of a major national environmental laboratory. In addition, he fulfilled the role of laboratory director of a mid-sized full service environmental laboratory.

PROFESSIONAL EXPERIENCE:

1990 to Present IEA-North Carolina, Inc.

Position Corporate Director of Quality Assurance

Responsibilities

Responsible for developing, implementing and maintaining a comprehensive corporate-wide quality assurance program. Also conducts periodic audits and inspections of all network laboratories. Provides primary leadership and guidance in standardizing methodologies and operating procedures at all lab locations and serves as official company spokesman on all QA matters including interaction with clients and regulatory agencies. Evaluates and approves the qualifications of potential subcontract laboratories prior to their use. Fulfills the role of QA Officer for corporate contracts and coordinates periodic QA audits by regulatory agencies and clients.

1987 to 1990 Environmental Testing and Certification, Inc.
Edison, New Jersey

Position Quality Assurance Manager-Network Development

Responsibilities

Designed and developed the EITC Network Quality Assurance Program and developed a comprehensive Quality Assurance Program for the lab Network. Reviewed the Quality Assurance Program and project

plans generated by Network and subcontract laboratories relative to U.S. EPA guidelines. Conducted on-site audits of each Network facility to ensure compliance with the Network QA Program and regulatory agency requirements. In addition, conducted audits of subcontract laboratories utilized by the Network. Fulfilled the role of QA Officer on several USATHAMA programs. Designed and implemented a computerized document control system for the Network. Developed a means of extracting specific data from the Network database to personal computers in order to conduct Quality Assurance assessments. Provided training courses on the use of personal computers to interested laboratory staff.

1986 to 1987

Environmental Testing and Certification, Inc.
Edison, New Jersey

Position

Program Manager

Responsibilities

Managed the groundwater monitoring program of the company's largest account which operated approximately 160 chemical and sanitary landfills across the country. Responsibilities in this capacity included sales forecasting, project development, project implementation and review of groundwater data. Interacted with regulatory agencies on client's behalf. Ensured compliance with Superfund-CLP protocol where required. Provided technical guidance to project management staff.

1978 to 1986

Recra Research Inc.
Amherst, New York

Position

Laboratory Director

Responsibilities

Managed an environmental laboratory of 38 full time personnel whose responsibility was to provide analytical services for environmental investigations and monitoring programs. Responsible for the technical quality of all data generated by the laboratory. Laboratory capabilities included atomic absorption spectroscopy, gas and liquid chromatography, as well as mass spectrometry (GC/MS). Designed and implemented a computer database system utilizing commercially available software for tracking of sample status, financial information and workload scheduling. Developed and implemented operating protocols acceptable to regulatory agencies for the analysis of water, waste water, sediment, solid waste, hazardous waste and ambient air. Designed and implemented a Quality Control/Quality Assurance program for the analytical services department. Established and implemented the laboratory health and safety program.

1974 to 1978

Great Lakes Laboratory
Buffalo, New York

Position

Research Associate

Responsibilities

Managed the laboratory phase of numerous EPA and Army Corps of Engineers funded projects that involved the analysis of water and sediment for chemical and biological parameters. Supervised and conducted various analytical tests utilizing automated autoanalyzers for wet chemical procedures. Received certification by Technicon Corporation as a qualified operator of their Autoanalyzer II system. Instructed a comprehensive (30 week, 40 hours per week) waste water treatment training course certified by the N.Y.S. Department of Environmental Conservation.

SPECIALIZED TRAINING:

Autoanalyzer Techniques-Certified Operator-Technicon Corporation, 1976
Column Selection/Gas Chromatography Course-Supelco, Inc., 1980
Management of the Analytical Chemistry Laboratory-Lab/Man Associates, 1983
Analysis of Priority Pollutants by GC/MS/DS-Finnigan Corporation, 1981
Improved Management of the Chemical Analysis Laboratory-McGraw Hill, 1984
High Resolution Gas Chromatography-Hewlett-Packard Corporation, 1981
Quality Assurance for Analytical Laboratories, AOAC, 1984
Time Management-S.U.N.Y. at Buffalo, School of Management, 1983
Assertive Management-S.U.N.Y. at Buffalo, School of Management, 1983

PROFESSIONAL AFFILIATIONS:

American Chemical Society
International Association of Environmental Testing Laboratories
National Environmental Laboratory Accreditation Coalition (NELAC)

Doc#-HRR00200.NET

PROFESSIONAL PROFILE
Jeffrey G. Spink

TITLE: Director of Operations-North Carolina

ACADEMIC ACCOMPLISHMENTS:

Rochester Institute of Technology
B.S. Business Management

MAJOR AREA OF EXPERTISE:

General Management
Laboratory Operations
Finance
Marketing and Sales

SUMMARY OF EXPERIENCE:

Mr. Spink has six years of diverse laboratory experience managing two of the largest environmental laboratories in the country. One of those laboratories was a leader in forensic drug testing and was NIDA certified. In addition, he has ten years of manufacturing and operational experience working for two fortune 25 companies. During his last 16 years, Mr. Spink has been involved in numerous phases of business management including start-up, ongoing operations, reorganization, and business divestiture.

PROFESSIONAL EXPERIENCE:

1991 to Present IEA-North Carolina, Inc.

Position Director, North Carolina Laboratory

Responsibilities

Overall management of a 125 person, 35,000 square foot environmental laboratory. Includes all aspects of sales and marketing, lab operations, QA/QC, new product development, human resources and finance. Involved with strategic planning, development, and implementation of a plan to transform the North Carolina laboratory from a medium sized local/regional lab to one of the largest and best quality national laboratories in the country. Responsible for the start-up of the newly built and licensed mixed waste facility.

1989 to 1991 CompuChem Laboratories
Sacramento, California

Position Vice President, Western Operations

Responsibilities

General Manager of a 55 person, 15,000 square foot, environmental laboratory and a 25 person, 5,000 square foot, forensic drug testing lab.

1987 to 1989 CompuChem Laboratories
Research Triangle Park, North Carolina

Position Project Manager, US Army

Responsibilities

50-million dollar Army contract which included over sight (sales, negotiation, management, etc.) of the entire project.

1986 to 1988

CompuChem Laboratories
Research Triangle Park, North Carolina

Position Corporate Director, Finance and Control

Responsibilities

-

Responsible for the day to day financial control including the start-up and maintenance of an environmental cost and operation control system.

1981 - 1986

Standard Oil of Ohio (BP)
Pfaudler Division
Rochester, New York

Position U.S. Controller

Responsibilities

All financial aspects of a \$60 million division including oversight of three manufacturing sites.

1976 - 1981

Eastman Kodak Company
Chemical Manufacturing Division
Roll Coating Manufacturing Division
Paper Finishing Division

Position Financial Operations Analyst

ADDITIONAL INFORMATION:

Board of Director for the Association of California Testing Labs as well as other professional affiliations.

PROFESSIONAL PROFILE
William (Bill) Drago

TITLE:

Laboratory Director, North Carolina

ACADEMIC ACCOMPLISHMENTS:

B.S. University of Alabama
Graduate studies toward M.S. Civil Engineering, Polytechnic Institute of New York

MAJOR AREA OF EXPERTISE:

Inorganic Chemistry
Operations Management
Project Management

SUMMARY OF EXPERIENCE:

Mr. Drago has 18 years in the environmental laboratory field as a Laboratory Director, Laboratory Manager, Chemist and Laboratory Technician. Part of the start up team for a national environmental laboratory.

PROFESSIONAL EXPERIENCE:

1992 to Present

IEA-North Carolina, Inc.

Position

North Carolina Laboratory Director

Responsibilities

Responsible for directing the laboratory's technical operations, laboratory personnel and ensuring the quality assurance standards. Provides technical support to staff and clients.

1988 to 1992

Gulf States Analytical, Inc.
Houston, Texas

Position

Laboratory Manager

Responsibilities

Responsible for the daily prioritization and project management for group leaders in the areas of GC, GC/MS, Sample Administration, Metals, Organics Extractions and Wet Chemistry. Project Manager of Gulf States' largest client. Aided in the planning and design of the new laboratory facility.

1985 to 1988

Malcolm Pirnie
White Plains, New York

Position

Laboratory Manager

Responsibilities

Prepared and managed operating budget, lease budget and capital budget. Implemented and managed laboratory services marketing plan. Developed and maintained GLP Manual and QA/QC plans. Conducted chemical analysis utilizing GC, and AA. Maintained and obtained laboratory certifications.

1978 to 1985

American Water Works, Inc.
Greenwich, Connecticut

Position

Laboratory Manager

Responsibilities

Managed a regional network utility laboratory. Conducted analysis utilizing GC, AA and Wet Chemical techniques. Acquired and maintained laboratory certifications.

1976 to 1978

Geological Survey of Alabama
University, Alabama

Position

Chemist

Responsibilities

Responsible for the collection and analysis of samples for a special US Army Corps of Engineers project. Conducted analysis utilizing GC and AA.

SPECIALIZED TRAINING:

Graduate of Phillip Crosby and Associates Quality Improvement Process Management College
Numerous seminars and courses pertaining to management issues.

PROFESSIONAL AFFILIATIONS:

American Chemical Society
American Water Works Association
Water Pollution Control Federations
Water and Wastewater Analysis Association

PUBLICATIONS:

Awarded U.S. Patent Number 4411157 for "Contamination Free Purge and Trap Vessel."

PROFESSIONAL CERTIFICATIONS:

Drinking Water Plant Operator, New York and Connecticut
Certified Laboratory Manager for the states of New Jersey, Florida, California, Wisconsin, Utah, and Oklahoma

PROFESSIONAL PROFILE
Linda Mitchell

TITLE:

Director, Technical Support Services

ACADEMIC ACCOMPLISHMENTS:

Huston-Tillotson College
B.S. Biology

MAJOR AREA OF EXPERTISE:

Environmental Laboratory Management
Research and Environmental Chemistry
Laboratory Quality Assurance
Data Review and Validation

SUMMARY OF EXPERIENCE:

Ms. Mitchell has over 18 years of experience in the laboratory environment. She has been laboratory manager of a small commercial environmental laboratory as well as fulfilled the role of Inorganic Laboratory Manager for a large engineering firm. Her experience includes research, field sampling, and QA program development data validation.

PROFESSIONAL EXPERIENCE:

1989 to Present IEA-North Carolina, Inc.

Position Director, Technical Support Services

Responsibilities

Coordinates Technical Services Department supporting the laboratory production area which includes: technical review, report generation and special projects requiring technical consultation. Responsible for the final technical review of data received from the laboratory and verifying that data will meet clients' request in content, completeness and accuracy, and accountable for its timely delivery. Designs and implements standard and special report packages. Maintains current knowledge of regulatory requirements in the industry and provides updates to the laboratory. Responsible for contract compliance and communication with the EPA in the Contract Laboratory Program.

1988 to 1989 Parsons Corporation-Engineering Science

Position Inorganic Laboratory Manager/QA Manager

Responsibilities

Restructured and reorganized the Corporate Laboratory, Inorganic Section, to produce high quality CLP data. Formulated and implemented Quality Assurance systems for identifying and solving compliance/procedural problems for analytical requirements. Developed and implemented systems for reporting to ensure the accurate and on-time delivery of data. Scheduled workload to ensure completion of analysis within protocol and meet delivery dates. Reviewed and approved all results for accuracy and compliance to meet Quality Assurance guidelines.

1980 to 1987

Parsons Corporation-Chas. T. Main, Inc.

Position

Laboratory Manager/Senior Laboratory Supervisor

Responsibilities

Responsible for the overall administration of the inorganic and organic laboratory providing full service to internal engineering staff and commercial clients. Developed and implemented laboratory operation budgets. Designed laboratory marketing brochure and developed sales and marketing plan. Responsible for Laboratory Health and Safety program. Provided field service assistance and sampling to clients and engineers meeting requirements for qualified field sample collection. Audited laboratories used in subcontract agreements for QA compliance.

1973 to 1980

Charlotte Memorial Hospital, A.M., VA Hospital; UT Health Science Center; Walter Reed Army Institute of Research

Responsibilities Experimental Researcher

SPECIALIZED TRAINING:

Analytical Quality Control - EPA, Region IV, 1986
Health and Safety Training: Hazardous Waste Operations - Phoenix Safety Assoc., 1987
Atomic Absorption Spectroscopy, Flame/Flameless - IL, 1981
Health Physics Aspects of Radioisotope Use - Walter Reed Army Medical Center, 1973

PUBLICATIONS:

Graybill, J.R., Mitchell, L.F., and H.B. Levine. 1978. Treatment of Murine Cryptococcosis: A comparisons of Miconazole and Amphotericin B. Antimicrobial Agents Chemotherapy. 13:277-283
Graybill, J.R., Craven, P.C., Mitchell, L.F. and D.J. Druz. 1978. Interaction of Chemotherapy and Immune Defenses in Experimental Murine Cryptococcosis. Antimicrobial Agents chemotherapy. 14:659-667
Treatment of Cryptococcosis: Is Amphotericin B the Whole Story? J.R. Graybill, Mitchell, L.F., and D.J. Druz. 1978. ICAAC
Failure of Miconazole Therapy in Experimental Cryptococcosis. J.R. Graybill, and Linda F. Mitchell. 1977. AFMR.

PROFESSIONAL PROFILE
Russ Parker

TITLE:

Director of Administration and Facilities

ACADEMIC ACCOMPLISHMENTS:

Lenoir Community College
Commercial Refrigeration and Air Conditioning

MAJOR AREA OF EXPERTISE:

Environmental Laboratory Design, Construction, Operation and Maintenance

SUMMARY OF EXPERIENCE:

Mr. Parker has more than 27 years diversified experience in laboratory operation and facility planning. Additional experience includes Pipe Fitter/Welder, Control Installations and Maintenance Technician, Laboratory Facilities Technician, Hazardous Waste Coordinator, Facilities Manager and Director of Administration. Expert in facilities operation and hazardous waste management. Management authority over several ongoing projects involving sophisticated laboratory facilities. Effective client consultant and director of general contractors. Highly qualified in directing new facility construction and development.

PROFESSIONAL EXPERIENCE:

1989 to Present

IEA-North Carolina, Inc.

Position

Corporate Director of Administration

Responsibilities

Responsible for all phases of the planning and implementation of major facilities changes including; construction and development responsibilities of the new IEA (Cary, North Carolina) facility; dealing with specialized building material items; scheduling, directing and monitoring work of architects, engineers, consultants and interior designers; and interface with city bureaucratic agencies. Approve interior design, decorating and signage. Maintain service contracts and assure reconstruction of office space. Coordinate and supervise transport companies and 5-member staff responsible for building moves and service. Charged with the administration of corporate facilities including recruiting, training and supervising personnel responsible for on-site operations. Oversee daily operations of on-site facilities including analyzing and solving building emergencies, construction, landscape, maintenance and repair work. Responsible for developing, implementing and maintaining corporate-wide purchasing policy. Negotiate and setup corporate discount purchase agreements with major vendors for laboratory supplies.

1980 to 1989

CompuChem Laboratories
Research Triangle Park, North Carolina

Position

Facilities Manager

Responsibilities

Created and directed construction, renovation and space utilization projects to facilitate company interest and development including HVAC, electrical, plumbing and communications systems. Responsible for construction and start up of new environmental laboratory facility in Chicago, Illinois. Responsible for

construction and start up of new drug testing laboratory and an environmental laboratory in Research Triangle Park, North Carolina. Managed Hazardous Waste Programs.

1974 to 1980

Becton Dickinson Research Center
Research Triangle Park, North Carolina

Position

Facilities Supervisor

Responsibilities

Responsible for all phases of facilities-operation and maintenance which included HVAC, electrical, plumbing and communication systems. Created and directed construction, renovation and space utilization projects as per company interest.

1970 to 1974

Honeywell, Inc.
Greensboro, North Carolina

Position

Control Technician

Responsibilities

Responsible for service relating to installation, maintenance and repair for commercial/medical facilities and maintenance/repair for industrial installations.

1963 to 1970

BF Shaw Construction Company
Kinston, North Carolina

Position

Pipe Fitter/Welder

Responsibilities

Responsible for fabrication and installation of piping systems from blue prints.

SPECIALIZED TRAINING:

Pipe Fitter/Welder Apprenticeship, BF Shaw Construction Company 1963-1968
Electric and Pneumatic controls Seminar, Honeywell-1970
Energy Management Course, Becton Dickinson-1974
Improving Boiler Efficiency, Becton Dickinson-1977
Hazardous Waste Management, NCSU-1982-1986
Fundamentals of Supervision, Capital Associated Industries-1986
Recognizing Chemical Dependency, Burke Taylor Associates-1988
Basic Principles of Leadership, Zinger Miller-1989

PROFESSIONAL PROFILE
Toivo E. Niemi

TITLE:

Quality Assurance Manager

ACADEMIC ACCOMPLISHMENTS:

Cornell University
B.A. Chemistry

University of Virginia
M.S. Environmental Sciences

MAJOR AREA OF EXPERTISE:

Environmental Laboratory Management
Environmental Chemistry

SUMMARY OF EXPERIENCE:

Mr. Niemi is an environmental chemist with more than ten years experience. As a graduate-level chemist and environmental scientist, he has in-depth knowledge of the operation and maintenance of GC and GC/MS systems. Mr. Niemi is highly skilled in the administration and operation of GC and GC/MS systems with emphasis on quality control requirements and data evaluation. Highly knowledgeable of mass spectral data interpretation through the analysis and review of instrument data systems and the preparation of final data reports.

PROFESSIONAL EXPERIENCE:

1991 to Present IEA-North Carolina, Inc.

Position Quality Assurance Manager

Responsibilities

Provides input and aids the continuing development of the Corporate QA Program and function as liaison between corporate QA and facility staff. Monitors the continuing compliance with the Corporate QA Program at the local facility. This includes preparing reports to lab management and corporate QA on lab performance in areas such as PE results, blind and double blind samples, holding times, report turnaround, corrective actions and data challenges. Coordinates all inquiries related to quality issues and follows up on corrective action as necessary. Resolves client/laboratory disputes as appropriate. Maintains an awareness of all corrective actions underway and ensure the existing process is fully functional.

1989 to 1991 IEA-North Carolina, Inc.

Position Manager, Chromatography Department

Responsibilities

Responsible for the timely, accurate, and efficient analysis of client samples prepared by the GC and GC/MS departments. Developed and maintained training programs for the chromatography staff.

Administered quality control requirements defined for the GC and GC/MS analysis. Evaluated sample data generated.

1984 to 1989

IEA-North Carolina, Inc.

Position

Mass Spectral Interpretation Specialist

Responsibilities

Analyzed and reviewed instrument data system. Evaluated computerized matches of unknown data against reference library data using electron impact ionization. Identified hardware and software instrument problems through the mass spectral data of standard reference compounds. Prepared final analytical data reports.

SPECIALIZED TRAINING:

GC/MS Operation and Maintenance - Finnigan Corporation, 1985

GC/MS Operation and Maintenance - Extrel Corporation, 1987

PROFESSIONAL AFFILIATIONS:

American Chemical Society

PUBLICATIONS:

McLafferty, Fred W., Peter J. Todd, Donald G. McGilvery, Michael A. Baldwin, Frank M. Bockhoff, Gregory J. Wendell, Michael R. Wixom and Toivo E. Niemi. "MS/MS: A New Separation/Identification Technique for Complex Mixtures." Advances in Mass Spectrometry 8B, 1589-96.

Doc#-HRR00500.NET

PROFESSIONAL PROFILE
Edgar E. Folk IV

TITLE:

Technical Officer

ACADEMIC ACCOMPLISHMENTS:

Wake Forest University, Winston-Salem, NC
B.A. in Chemistry

MAJOR AREA OF EXPERTISE:

Environmental Chemistry
Chromatography
Pesticide Analysis

PROFESSIONAL EXPERIENCE:

1988 to Present IEA-North Carolina, Inc.

Position Technical Officer

Responsibilities

Develop and troubleshoot methodologies for new products requested by clients. Set-up and troubleshoot analytical instruments. Provide input in determining the feasibility and selection of new and appropriate instrumentation. Bring new instruments on-line as well as upgrade existing equipment and methodologies. Evaluate new instruments for performance and feasibility. Technical liaison with Air Division.

1985 to 1988 IEA-North Carolina, Inc.

Position GC Department Supervisor

Responsibilities

Supervised all department personnel. Maintained certification under CLP, SDWA, and NPDES programs. Performed duties of the Pesticides Residue Expert in accordance with the guidelines set forth by the CLP contract. Scheduled all analysis and reviewed data generated. Performed methods development for specific client needs. Operated, troubleshoot, and maintained 16 GCs in proper working condition. Coordinated training of new employees.

1983 to 1985 Grainger Laboratories, Inc.
Raleigh, North Carolina

Position Staff Chemist

Responsibilities

Maintained certification for SDWA, NPDES and USDA programs. Performed routine and non-routine analysis including EPA methods 608, 610, 624, 625, NIOSH methods and Standard Methods 509A and 509B. Analyzed transformer oils for polychlorinated biphenyls. Analyzed municipal drinking water for trihalomethanes.

1982 to 1983

Webb Food Lab
Raleigh, North Carolina

Position

Head Chemist

Responsibilities

Performed analysis of animal fat and tissue for pesticide residues and polychlorinated biphenyls under a USDA contract. Developed a solvent system for column chromatography. Set up department from ordering equipment to organizing QA program. Maintained USDA certification.

1981 to 1982

NC Department of NRCP
Cary, North Carolina

Position

Chemical Analyst

Responsibilities

Performed analysis of environmental matrices (groundwater, surface water, sediments, and tissue) for herbicide and pesticide residues by gas chromatography. Performed priority pollutant analysis of environmental matrices by GC/MS.

SPECIALIZED TRAINING:

Managing Multiple Projects, Priorities and Deadlines - Skill Path, Inc., 1990
Liquid Chromatography, Waters Chromatography Division, 1985
Target for HP-UX - Hewlett-Packard, 1990
Analytical Gas Chromatography - J & W Scientific, 1989
GC/MS System Manager - Hewlett-Packard, 1985
Headspace Sampling for GC - Hewlett-Packard, 1988
Introduction to HPLC - ACS 1989
Recent Advances in HPLC - ACS 1989
Supercritical Fluid Extraction and Chromatography - Lee Scientific, 1989
Environmental Analysis - Dionex Corporation, 1989
Innovations in Inorganic Analysis, Waters Chromatography Division, 1990
Environmental Forum - Tekmar Company, 1989
Basics of DOS - Dunn and Bradstreet, 1989
Workshop on Sampling and Analysis Methods for Compliance with the BIF Regulation
USEPA, 1990, 1991
Analysis of Pollutants in the Environment - USEPA, 1989, 1990, 1991
Pittsburgh Conference and Exposition, 1986, 1989, 1990, 1991
Assertiveness Training, 1989
A Day with the Experts - Solid Phase Extraction, Varian, 1991
Triangle Chromatography Symposium - Triangle Chromatography Discussion Group,
1986, 1987, 1988, 1989, 1990, 1991
EPA Methods Caucus, USEPA, 1989, 1991

PROFESSIONAL AFFILIATIONS:

American Chemical Society
American Industrial Hygiene Association

PRESENTATIONS:

The Use of High Efficiency Columns for Gel Permeation Cleanup of Environmental Sample Extracts,
USEPA, OSWER, Methods Caucus, 1991

Doc#-HRR00800.NET

PROFESSIONAL PROFILE
Donald Stogner

TITLE: Inorganic Lab Manager

ACADEMIC ACCOMPLISHMENTS:

North Carolina State University
B.S. Chemistry
Minor, Computer Science

MAJOR AREA OF EXPERTISE:

Inorganic Chemistry

SUMMARY OF EXPERIENCE:

Mr. Stogner has experience in several major areas of inorganic chemistry including ICP/MS, ICP-AES, GFAAS, Wet Chemistry, UV/Vis Spectroscopy and Cold Vapor AA.

PROFESSIONAL EXPERIENCE:

1991 to Present IEA, Inc.
North Carolina

Position Manager, Inorganic Laboratory

Responsibilities

Responsible for managing both the wet chemistry laboratory as well as the metals area. Reviews data from labs and assesses quality and methodology. He is responsible for all aspects of both laboratory areas.

1985 to 1991 CompuChem Laboratories
RTP, North Carolina

Position Supervisor/Chemist Inorganic Laboratory

Responsibilities

Responsible for analysis of samples and supervision of other chemist in inorganic lab. Responsible for problem solving and data quality. Responsible for all aspects from sample prep to final report.

SPECIALIZED TRAINING:

Various seminars on ICP/MS, ICP-AES, GFAAS, Air Monitoring and Instrument Maintenance

PROFESSIONAL PROFILE
David Bubacz

TITLE: Supervisor, Inorganic Chemistry

ACADEMIC ACCOMPLISHMENTS:

Western Carolina University, Cullowhee, NC
B.S. in Chemistry, 1984

MAJOR AREA OF EXPERTISE:

Inorganic Chemistry Lab (Bench Chemistry)
Inorganic Laboratory Management
Ambient Air Monitoring: Sampling and Instrumentation (EPA)

SUMMARY OF EXPERIENCE:

Mr. Bubacz has one year of graduate level research using TLC, liquid and gas chromatography and organic synthesis. He has spent four years as an EPA contractor developing methods for generating and measuring sub-ppb level concentrations of inorganic pollutants. Since 1988, he has assumed responsibility for managing the inorganic department at IEA; including method development and improvements in quality control.

PROFESSIONAL EXPERIENCE:

1988 to Present IEA, Inc.
Cary, North Carolina

Position Supervisor, Inorganic Laboratory

Responsibilities

Duties include maintaining production of inorganic laboratory, performing classical wet chemical and spectroscopic analysis of environmental analytes. Responsibilities also include implementation and modification of methods of analysis as new technologies and capabilities become available. Major accomplishments include developing a comprehensive quality assurance program within the laboratory and bringing laboratory capabilities and capacities to CLP deliverable quality.

1984 to 1988 Northrop Services, Inc.

Position Associate Scientist

Responsibilities

Primary responsibilities included the development and implementation of precision gas dilution systems for ambient air pollutants in the testing and evaluation of prototype air samplers and instrumentation. Responsibilities included the evaluation of instruments for real-time NO₂ monitors, SO₂ and NO_x analyzers for EPA certification in air pollution studies.

Laboratory expertise was centered on impinger studies for nitric acid, various chemically coated filters for selectively trapping chemical pollutants and designing a highly efficient gas dilution manifold for performing controlled laboratory experiments on prototype instrumentation.

SPECIALIZED TRAINING:

Supervising People, Dunn and Bradstreet, 1988
The Technical Person in a Leadership Role, Fred Pryor, 1989
Handling Difficult People, Fred Pryor, 1990
Managing Multiple Priorities, Dunn and Bradstreet, 1990

PUBLICATIONS:

Luminox Measurements of Ambient NO₂, Symposium on Toxic Air Pollutants, American Pollution Control Association, EPA, 1987, Raleigh, NC.
Real-Time NO₂ Measurement: Evaluation of a Real Time Analyzer and Development of a novel Dynamic Dilution Manifold, Technical Report, 1986. Northrop Services, Inc.

Doc#-HRR01300.NET

PROFESSIONAL PROFILE
Keith B. Scott

TITLE: Manager, Gas Chromatography Laboratory
Manager, Sample Preparation Laboratory

ACADEMIC ACCOMPLISHMENTS:

University of North Carolina - Wilmington
B.S. Biology

MAJOR AREA OF EXPERTISE:

Environmental testing utilizing gas chromatographic techniques.
Organic sample preparation.
Environmental Laboratory Management

SUMMARY OF EXPERIENCE:

Mr. Scott has been involved in organic sample preparation and gas chromatographic analyses for five years. He is proficient in various methodologies including volatiles, pesticides, herbicides, PCBs, petroleum hydrocarbons, and the organic extractions associated with them. He has over two years experience with the EPA contract laboratory programs pesticide analysis. In addition, he has over three years laboratory supervisory/management experience.

PROFESSIONAL EXPERIENCE:

1991 to Present IEA-North Carolina, Inc.

Position Manager, Gas Chromatography
Manager, Sample Preparation

Responsibilities
Responsible for the overall operation of both the Gas Chromatography and sample preparation departments. This includes maintaining adherence to IEA quality control and quality assurance objectives, turnaround requirements, and budgetary requirements. Researches and implements new methodologies and instrument upgrades.

1990 to 1991 IEA-North Carolina, Inc.

Position Assistant Manager, Organics Division

Responsibilities
Responsible for operations in both the GC and sample prep laboratories.
Insure timeliness of data generation and review.
Assist Organics Manager as needed.

March 1989 to Dec. 1990

IEA, Inc.
Cary, North Carolina

Position

Supervisor, GC Department

Responsibilities

Responsible for all operations in the GC laboratory. this included production in the areas of pesticides, volatiles, and petroleum hydrocarbons.

Supervised all analysis and conducted performance evaluations.

Maintained instrumentation in proper working condition.

Reviewed all data prior to releasing to clients.

July 1988 to March 1989

IEA, Inc.
Cary, North Carolina

Position

Asst. Supervisor, GC Department

Responsibilities

Ensured production requirements were met in all areas of GC laboratory.

Reviewed data for analytical integrity.

Assisted Department Supervisor as required.

July 1987 to July 1988

IEA, Inc.
Cary, North Carolina

Position

Coordinator, Screening Department

Responsibilities

Coordinated the screening of all organic samples prior to analysis. Screening was performed by GC/FID and GC/ECD. This included volatile, semivolatile; and pesticide samples.

Oct. 1986 to July 1987

IEA, Inc.
Cary, North Carolina

Position

GC Operator

Responsibilities

Responsible for the analysis and data interpretation of volatiles, pesticides, herbicides, PCBs, EDB's and DBCP, petroleum hydrocarbons and special projects.

July 1986 to Oct. 1986

IEA, Inc.
Cary, North Carolina

Position

Laboratory Technician I

Responsibilities

Performed organic extractions on BNAs, oil and grease, pesticides, herbicides, and PCBs.

Operated IR spectrophotometer for oil and grease interpretations.

Performed gel permeation cleanup on organic samples.

SPECIALIZED TRAINING:

HPLC Carbamate Pesticide Analysis - Waters Corporation

Doc#-HRR01100.NET

PROFESSIONAL PROFILE
Kerry Hinshaw

TITLE:

GC Department Supervisor

ACADEMIC ACCOMPLISHMENTS:

Two and a half years of study at UNC-Chapel Hill majoring in Zoology. Fifteen semester hours of Chemistry

MAJOR AREA OF EXPERTISE:

EPA CLP Pesticide/PCB residue analysis.
Environmental Testing using various Gas Chromatography Systems.
Chromatographic Data System Management.
Organic Sample Preparation.

SUMMARY OF EXPERIENCE:

Mr. Hinshaw has seven years of Gas Chromatography and organic sample preparation experience working with many GC methodologies including pesticides, PCB's, Herbicides, Petroleum Hydrocarbons and Volatiles. Six years experience with EPA CLP Pesticide analyses. Six years experience with Chromatographic Data Systems, one year of Data System Management. One and a half years of supervisory experience.

PROFESSIONAL EXPERIENCE:

1991 to Present

IEA, Inc.
North Carolina

Position

GC Department Supervisor

Responsibilities

Supervising personnel in the GC Pesticide section.
Review of EPA CLP Pesticide Data Packages
Review of all Pesticide/PCB and Herbicide Data.
Maintain and expand IEA certifications
Troubleshooting and maintenance of instrumentation.
Maintenance of two Hewlett-Packard Analytical Data Systems.

1989 to 1991

IEA, Inc.
North Carolina

Position

GC Department Assistant Supervisor

Responsibilities

Overseeing production in the Pesticide and Petroleum Hydrocarbons areas.
Review of EPA CLP Pesticide Data Packages.
Review of all Pesticide/PCB and Herbicide Data.
Troubleshooting and maintenance of instrumentation.
Training new Analysts.
Assisting GC Supervisor as needed.

1988 to 1989

IEA, Inc.
Cary, North Carolina

Position

GC Analyst II/Production Coordinator
Second Shift

Responsibilities

Analysis and data reduction of Pesticide/PCB's and Herbicides using various methodologies, including EPA CLP Pesticides. ~
Overseeing production in all areas of the GC Lab on Second Shift (6/89-12/89). ~
EPA CLP Pesticide Forms Generation. ~
Troubleshooting and Maintenance of instrumentation.

1986 to 1988

CompuChem Laboratories
Research Triangle Park, North Carolina

Position

Senior GC Technician
Second Shift

Responsibilities

Analysis of environmental samples by GC using EPA CLP, 8080, 608, 8150, 601/602, 8010/8020 and various other methodologies.
Troubleshooting and maintenance of instrumentation.
Assisting GC Chemists in Method Development.

1985 to 1986

CompuChem Laboratories
Research Triangle Park, North Carolina

Position

Extraction Technician

Responsibilities

Preparation of Environmental samples for analysis by GC and GC/MS.
Determination of sample pH and soil sample percent moisture for EPA CLP samples.

SPECIALIZED TRAINING:

Introduction to Capillary Chromatography (Dr. Walter Jennings - J&W)
LAS 3350A System Manager Course (Hewlett-Packard)

Doc# HRR09900.NET

PROFESSIONAL PROFILE
Laura Cox

TITLE:

GC Supervisor

ACADEMIC ACCOMPLISHMENTS:

North Carolina State University
B.S. Biological Life Sciences

MAJOR AREA OF EXPERTISE:

Gas chromatography (FID, ECD, PID, HALL)

SUMMARY OF EXPERIENCE:

Ms. Cox has a background in biology with extensive experience in developing GC methods, coordinated production in GC-volatile and GC-extractable projects for commercial and level III clients.

PROFESSIONAL EXPERIENCE:

1991 to Present

IEA-North Carolina, Inc.

Position

GC Supervisor

Responsibilities

Supervises and coordinates daily workload, maintains instrumentation in the laboratory, revises and updates standard operating procedures to reflect current methodologies. Conducts final review of all level III data and GC-extractable data.

1990 to 1991

IEA-North Carolina, Inc.

Position

GC Assistant Supervisor

Responsibilities

Tracked production in GC department that included volatiles, TPH's, 604's, 606's, and 610's. Reviewed data on all above parameters and troubleshooted instruments.

1988 to 1990

IEA-North Carolina, Inc.

Position

GC Operator

Responsibilities

Responsible for analysis of volatiles, TPH's, 604's, 606's, 610's, special projects, EDB/DBCP's, and screening. Track production to insure all samples were run within protocol.

SPECIALIZED TRAINING:

HP1000 Data System Training Course
HP GC Operator School
HP GC Troubleshooting Training

HRR09400.NET

PROFESSIONAL PROFILE
William D. Springer

TITLE: Sample Preparation Laboratory Supervisor

ACADEMIC ACCOMPLISHMENTS:

University of Pittsburgh
B.S. Elementary Education

North Carolina State University
Coursework in Chemistry, Present

MAJOR AREA OF EXPERTISE:

Sample preparation and method implementation of environmental samples.

SUMMARY OF EXPERIENCE:

Mr. Springer has over four years of experience in the preparation of environmental samples for analysis by EPA promulgated methodologies. He is proficient in the preparation and concentration techniques utilized by the EPA Contract Laboratory Program. He has a working knowledge of Gel Permeation Chromatography, Gas Chromatography, and Infrared Spectroscopy instrumentation.

PROFESSIONAL EXPERIENCE:

1991 to Present IEA-North Carolina, Inc.

Position Sample Preparation Laboratory Supervisor

Responsibilities

Responsible for all technical efforts of sample preparations to meet the requirements and conditions of the EPA CLP Statement of Work. Coordinates and schedules the preparation of environmental samples to maintain a continuous flow of sample extracts to the GC and GC/MS departments. Supervises and schedules the training of the extraction and concentration staff. Performs preventative maintenance of sample preparation instrumentation, including the GPC, GC, and IR.

1989 to 1991 IEA-North Carolina, Inc.

Position Assistant Supervisor - Sample Preparation Laboratory

Responsibilities

Supervised extraction and concentration staff. Assisted in the training of new personnel. Extracted and prepared environmental samples according to EPA CLP protocols.

1987 to 1989 IEA-North Carolina, Inc.

Position Extraction/Concentration Expert

Responsibilities

Responsible for the extraction and concentration of environmental samples for chromatographic analysis according to EPA CLP protocols.

Doc#-HRR07900.NET

PROFESSIONAL PROFILE
Debbie Smith

TITLE: GC/MS Volatiles Laboratory Assistant Supervisor
Mass Spectral Interpretation Specialist

ACADEMIC ACCOMPLISHMENTS:

Marshall University at Huntington, West Virginia
B.A. in Chemistry

MAJOR AREA OF EXPERTISE:

Environmental Trace Organic Analysis
Environmental Data Review

SUMMARY OF EXPERIENCE:

Ms. Smith has over five years experience in the analyses and data review of trace Organics in environmental matrices utilizing Gas Chromatography and Gas Chromatography/ Mass Spectroscopy. Previous experience includes method development, supervision, and interaction with clients.

PROFESSIONAL EXPERIENCE:

1991 to Present IEA-North Carolina, Inc.

Position GC/MS Volatiles Laboratory Assistant Supervisor

Responsibilities

Responsible for GC/MS volatile data review, coordinating laboratory production, and trouble shooting of instrumentation. Mass Spectral Interpretation of computer identified compounds. Training of GC/MS personnel in the volatiles laboratory.

1990 to 1991 Research Triangle Labs
RTP, NC

Position GC/MS Chemist

Responsibilities

Analyzed environmental air samples from various sampling methods utilizing GC/MS with Thermal Desorption Apparatus. Data Review: from initial to final technical review. Developed the TO - 14 canister analysis. Interacted with clients concerning technical matters.

1989 to 1990 EMS - Heritage Labs
Charlotte, NC

Position GC/MS Chemist / Supervisor

Responsibilities

Supervised the GC/MS Department. Completed analysis of water and soil samples for volatiles and semivolatile organic compounds. Performed data review.

1987 to 1989

Compuchem Laboratories, Inc.
Research Triangle Park, NC

Position Chemist / Data Review Specialist

Responsibilities

Responsible for GC/MS analyses of water and soil samples for trace volatile organics. Group leader for the second shift. Reviewed semi-volatile GC/MS data for CLP and commercial clients.

1987 to 1987

IEA-North Carolina, Inc.

Position GC Operator

Responsibilities

Responsible for operation of Gas Chromatography instrumentation utilizing the following detectors: FID, PID/Hall, ECD. Analysis of the following: PCBs, Pesticides, THMs, HDBs, and volatiles.

August 1986 to February 1987

ESI, Inc.
Raleigh, NC

Position

Environmental Scientist / Lab Supervisor

Responsibilities

Responsible for supervising over six analysts and all technical aspects of the laboratory.

Interaction with clients.

Developed and implemented an Intra/Inter Lab QA/QC program.

Analyzed samples for the presence of asbestos utilizing Polarized Light, Microscopy, and Phase Contrast Microscopy.

SPECIALIZED TRAINING:

Swagelok Training - Raleigh Valve and Fitting, 1991.

NIOSH Course on Asbestos Fiber Counting

24 hour safety training

PROFESSIONAL AFFILIATIONS:

American Industrial Hygiene Association

Doc#-HRR01600.NET

PROFESSIONAL PROFILE
Dawn Alesia Casto

TITLE:

GC/MS Volatiles Laboratory Supervisor
Mass Spectral Interpretation Expert

ACADEMIC ACCOMPLISHMENTS:

Western Carolina University
B.S. in Chemistry and Biology, 1986

North Carolina State University
Coursework in Economics, Present

MAJOR AREA OF EXPERTISE:

Five years of environmental laboratory experience.
Analysis of environmental samples for volatile organics by GC and GC/MS.
Analysis of environmental sample extracts for pesticide, polychlorinated biphenyl, and herbicide residues.
Generation of EPA CLP Data packages including forms generation.

SUMMARY OF EXPERIENCE:

Ms. Casto has over five years of environmental laboratory experience. Her experience ranges from bench level wet chemistry through chromatographic instrumentation analyses. She is proficient in the operation of both gas chromatographs and mass spectrometers for the analysis of organic analytes, including volatile organics, semi-volatile organics, pesticides, petroleum hydrocarbons and polychlorinated biphenyls. Ms. Casto also has experience in the preparation and generation of CLP data packages.

PROFESSIONAL EXPERIENCE:

1991 to Present IEA-North Carolina, Inc.

Position Supervisor - GC/MS Volatiles Laboratory

Responsibilities

All technical efforts of the volatile laboratory to meet all the requirements and conditions of the EPA CLP Statement of Work. Supervises and trains GC/MS personnel in the volatiles laboratory. Management, including production/coordination of sample analyses. Reviews volatile data packages to ensure the validity and completeness of the data. Interprets mass spectra to verify identification of detected analytes.

1991 to 1991 IEA-North Carolina, Inc.

Position GC/MS Assistant Supervisor

Responsibilities

Reviewed volatile and semi-volatile data packages. Assisted in the training for GC/MS operators. Duties included EPA CLP forms generation and preparation of completed data packages.

1989 to 1989 IEA-North Carolina, Inc.

Position GC/MS Operator

Responsibilities

Responsible for analysis of environmental sample for volatile organics. Performed preventative maintenance as required. Prepared analytical reference standards and was responsible for quality assurance of generated data.

1987 to 1989 IEA-North Carolina, Inc.

Position GC Analyst

Responsibilities

Responsible for analysis of environmental sample extracts for pesticide, polychlorinated biphenyls, and herbicide residues. Analyzed environmental samples for volatile aromatics and volatile halocarbons by purge-and-trap techniques.

1986 to 1987 IEA-North Carolina, Inc.

Position Chemical Analyst

Responsibilities

Responsible for environmental analysis by wet chemistry techniques. Techniques included titration and ion-specific probe, and Karl-Fischer. BOD analysis of environmental samples for NPDES permits.

SPECIALIZED TRAINING:

Data system training - Spectra-Physics, 1988

Analytical Gas Chromatography - J&W Scientific, 1989

Swagelok Training - Raleigh Valve and Fitting, 1991

Doc#-HRR01500.NET

Gregory A. Hirabec

Manager - Sample Management Department

ACADEMIC ACCOMPLISHMENTS:

Ferris State University
B.S. in Finance

MAJOR AREA OF EXPERTISE:

Shipping and Receiving Inventory Control

SUMMARY OF EXPERIENCE:

Mr. Hrabec has three years of experience in shipping and receiving and inventory control procedures.

PROFESSIONAL EXPERIENCE:

IEA-North Carolina, Inc.

Position **Manager - Sample Management Department**

Responsibilities

Responsible for the efficient operation of sample management including assuring the accuracy and timeliness of log-in, coordination of Transpak services, and maintaining sample storage facilities and disposal procedures.

P. Facilities

IEA-North Carolina occupies a 32,000 square foot building of which approximately 70% is dedicated to the analytical laboratories. Separate laboratory areas are dedicated to GC instrumentation, GC/MS instrumentation, extractions for organic parameters, sample preparation for metals analysis, metals analysis by atomic absorption (GFAA), metals analysis by inductively coupled plasma (ICP), metals analysis by ICP/MS, and standards preparation.

The laboratory is divided into eighteen (18) temperature controlled zones. The volatiles analysis laboratory containing both GC and GC/MS instrumentation has a separate air handling system which is maintained at a positive pressure at all times. The semivolatiles analysis laboratory, as well as the organic sample preparation laboratory, have separate HVAC systems that create negative pressure in the respective areas. This design results in a contaminant-free environment for trace-level volatiles analysis.

The laboratory has twenty (20) fume hoods strategically located for a total of over 119 linear feet to hood capacity. 110/220 volt circuits power the instrumentation. Critical instrumentation such as GC/MS units, ICP's, AA's, data systems and gas chromatographs are equipped with uninterruptable power supplies (UPS).

Inorganic laboratory reagent water is produced by a Millipore reverse osmosis unit which feeds a 30 gallon storage tank which in turn feeds a Barnstead deionization water system.

Volatile organic-free water is generated by passing tap water through prefilters and a series of activated carbon tanks. The quality of the volatile-free water is verified on a daily basis through instrumental analysis.

Organic free water (except volatile) is generated using a commercial system consisting of a 1.0 micron prefilter, mixed bed deionizers and an activated carbon tank in series. This water is subjected to extraction with methylene chloride solvent prior to use for organic analyses.

The glassware preparation area is equipped with two 24 cubic foot muffle furnaces. All extraction and sample preparation glassware is treated at 450°C for 4 hours immediately prior to each usage.

Four locked commercial refrigerator units are used to house samples waiting for analysis. Twelve locked laboratory refrigerators, located throughout the laboratory, are used to maintain sample extracts or laboratory reagents. Each laboratory refrigerator is dedicated to sample, sample extract, or reagent storage.

Access to the laboratory facility is secured through the use of an electronic card access system for all perimeter entrances. All visitors are required to enter through the front entrance, must sign in and are escorted while inside the building.

Q. Organic Contract Laboratory Program Instrumentation

Gas Chromatography/Mass Spectrometry DepartmentSemivolatiles Section

<u>INSTRUMENT ID</u>	<u>DESCRIPTION</u>
EXTR3	Extrel ELQ-400 GC/MS equipped with Hewlett-Packard 5890 GC Hewlett-Packard 7673A Autosampler DEC PDP-11 Computer Graph-On GO-235 Terminal 160 Mb CDC Disk Drive Cipher 9-track Magnetic Tape System Printtronix P4000 Printer
EXTR4	Extrel ELQ-400 GC/MS equipped with Hewlett-Packard 5890 GC Hewlett-Packard 7673A Autosampler Graph-On GO-235 Terminal 160 Mb CDC Disk Drive Cipher 9-track Magnetic Tape System Printtronix P600 Printer
MSD8	Hewlett-Packard 5971A MSD equipped with Hewlett-Packard 5890 Series II GC Hewlett-Packard 7673A Autosampler UNIX Chemstation Model 345 Computer HP6000 660S Disk Drive with DAT HP LaserJet III Printer

Gas Chromatography/Mass Spectrometry DepartmentSemivolatiles Section

<u>INSTRUMENT ID</u>	<u>DESCRIPTION</u>
MSD6	Hewlett-Packard 5971A MSD equipped with Hewlett-Packard 5890 Series II GC Hewlett-Packard 7673A Autosampler UNIX Chenstation Model 345 Computer HP6000 660S Disk Drive with DAT HP LaserJet III Printer

Gas Chromatography/Mass Spectrometry Department
Volatiles Section

<u>INSTRUMENT ID</u>	<u>DESCRIPTION</u>
MSD5	Hewlett-Packard 5970B MSD equipped with Hewlett-Packard 5890 Series II GC Tekmar LSC-2000 with MCM Tekmar ALS-2016 Tekmar Sample Heaters UNIX Chemstation Model 340C + Computer HP9144A Tape Drive 304 Mb Winchester Disk Drive Hewlett-Packard LaserJet II Printer
MSD10	Hewlett-Packard 5970B MSD equipped with Hewlett-Packard 5890 Series II GC Tekmar LSC-2000 Tekmar ALS-2016 Tekmar Sample Heaters UNIX Chemstation Model 345 Computer HP6000 660S Disk Drive with DAT HP 2934A Printer LaserJet II Printer
MSD7	Hewlett-Packard 5970B MSD equipped with Hewlett-Packard 5890 Series II GC Tekmar LSC-2000 with MCM Tekmar ALS-2016 Tekmar Sample Heaters UNIX Chemstation HP Apollo Series 400 Computer HP6000 660S Disk Drive with DAT HP 2934A Printer

Gas Chromatography/Mass Spectrometry Department
Volatiles Section

<u>INSTRUMENT ID</u>	<u>DESCRIPTION</u>
MSD9	Hewlett-Packard 5971 MSD equipped with Hewlett-Packard 5890 Series II GC Tekmar LSC-2000 with MCM Tekmar ALS-2016 Tekmar Sample Heaters UNIX Chemstation HP Apollo Series 400 Computer HP6000 660S Disk Drive with DAT HP Rugged Writer Printer
	Hewlett-Packard Stand Alone Data System equipped with HP Apollo Series 400 Computer HP6000 660S Disk Drive with DAT HP 98754A Monitor Panasonic KX-P4450I Laser Printer

Gas Chromatography Department
Pesticide Section

<u>INSTRUMENT ID</u>	<u>DESCRIPTION</u>
HP5890P1 HP5890P3	Hewlett-Packard 5890 Series II GC equipped with 2 Electron-Capture Detectors Hewlett-Packard 7673 Dual Tower Autosampler Hewlett-Packard 3396 Series II Integrator Hewlett-Packard 35900 Dual Channel Interface
HP5890P2 HP5890P4	Hewlett-Packard 5890 Series II GC equipped with 2 Electron-Capture Detectors Hewlett-Packard 7673 Dual Tower Autosampler Hewlett-Packard 3396 Series II Integrator Hewlett-Packard 35900 Dual Channel Interface
HP5890P5 HP5890P6	Hewlett-Packard 5890 Series II GC (upgraded) equipped with 2 Electron-Capture Detectors Hewlett-Packard 7673 Dual Tower Autosampler Hewlett-Packard 3392A Integrator Hewlett-Packard 35900 Dual Channel Interface
SCREENING	Perkin Elmer Sigma 3B GC equipped with Electron Capture Detector Flame Ionization Detector Hewlett-Packard 3390A Integrator Perkin Elmer AS-300 Autosampler Hewlett-Packard 3350A Central Data System equipped with Hewlett-Packard A400 Series Computer Hewlett-Packard Model 7959B Disk Drive Hewlett-Packard Model 9144 16-Track Tape Drive

Sample Preparation Department

<u>INSTRUMENT ID</u>	<u>DESCRIPTION</u>
GPC1	Waters Gel Permeation Chromatograph equipped with Waters Model 715 Ultra WISP Autosampler Waters Model 510 Pump Waters Model 484 Tunable Absorbance Detector Waters Fraction Collector Perkin-Elmer LCI-100 Integrator
GPC2	Waters Gel Permeation Chromatograph equipped with Waters Model 715 Ultra WISP Autosampler Waters Model 510 Pump Waters Model 486 Tunable Absorbance Detector Waters Fraction Collector Spectra-Physics SP4400 Chromlet Integrator
FID1	Hewlett-Packard 5890 Series II GC Hewlett-Packard 7673 Dual Tower Autosampler 2 Flame Ionization Detectors 2 Hewlett-Packard 3396A Integrators
FID2	Tracor 540 GC equipped with Flame Ionization Detector Hewlett-Packard 3390A Integrator 9 Tekmar Sonic Disruptors equipped with 3/4" Q Horns

R. Other Laboratory Instrumentation

Gas Chromatography Department

- 1 Perkin Elmer Sigma 300 GC equipped with
Photo Ionization Detector
700A Hall Electrolytic Conductivity Detector
Tekmar ISC-2 Purge & Trap Unit
Tekmar ALS Autosampler
Spectra-Physics SP-4290 Integrator
Flame-Ionization Detector
- 1 Perkin Elmer Sigma 300 GC equipped with
Photo Ionization Detector
700A Hall Electrolytic Conductivity Detector
Tekmar ISC-2 Purge & Trap Unit
Spectra-Physics SP-4290 Integrator
Tekmar ALS Autosampler
- 1 Perkin Elmer Sigma 2 GC equipped with
Flame Ionization Detector
Nitrogen Phosphorus Detector
Tekmar ISC-2 Purge & Trap Unit
LCI-100 Integrator
- 1 Perkin Elmer Sigma 300 GC equipped with
Electron Capture Detector
Flame Photometric Detector
Perkin Elmer AS-300 Autosampler
Spectra-Physics SP-4290 Integrator
- 1 Tracor 540 GC equipped with
Electron Capture Detector
Flame Photometric Detector
Spectra-Physics SP-4290 Integrator
Tracor 771 Auto Sampler
- 1 Perkin Elmer Sigma 1B GC equipped with
Electron Capture Detector
Connected to Sigma 15 Data System
- 1 Perkin Elmer Sigma 300 GC equipped with
2 Flame Ionization Detectors
Perkin Elmer AS-30 Auto Sampler
Spectra-Physics SP-4400 Chromjet

Gas Chromatography Department

- 1 Perkin Elmer Sigma 300 GC equipped with
2 Flame Ionization Detectors
Spectra-Physics SP-4290
- 1 Tracor 540 GC equipped with -
2 Flame Ionization Detectors
Hewlett-Packard 3396A Integrator
- 1 Tracor 540 GC equipped with
Flame Ionization Detector
Spectra-Physics SP-4290 Integrator
Hall 1000 Electrolytic Conductivity Detector
Hewlett-Packard HP 19395A Headspace Sampler
- 1 Perkin Elmer 910 GC equipped with
Thermal Conductivity Detector
Shimadzu CR3A Integrator
- 1 Hewlett-Packard 5890 GC equipped with
2 Flame Ionization Detectors
7673 Dual Tower Autosampler
Hewlett-Packard 3396A Integrator
Spectra-Physics SP-4290 Integrator
- 1 Tracor 9000 GC equipped with
Photoionization Detector
Hall 1000 Electrolytic conductivity Detector
Tekmar LSC-2000 Purge and Trap Unit
Tekmar ALS-2016 Autosampler
Spectra-Physics Chronjet Integrator
- 1 Perkin - Elmer 8500 GC equipped with
Flame Ionization Detector
Hall 1000 Electrolytic Conductivity Detector
HS-101 Automatic Headspace Sampling Unit
Spectra-Physics SP-4290 integrator
- 1 Tracor 540 GC equipped with
Photo-Ionization Detector
Hall 1000 Electrolytic Conductivity Detector
Spectra-Physics SP-4290 Integrator
Tekmar LSC-2000 Purge-and-Trap Unit
Tekmar ALS-2016 Auto Sampler

Gas Chromatography Department

- 2 Hewlett - Packard 5890 Series II GC equipped with
 - 2 Flame-Ionization Detectors
 - 7673A Dual Tower Autosampler
 - 2 Hewlett - Packard 3396A Integrators
- 1 Tracor 540 GC equipped with
 - Photo-Ionization Detector
 - Flame-Ionization Detector
 - Tekmar LSC-2000 Purge-and-Trap Unit
 - Tekmar ALS-2016 Autosampler
 - Spectra-Physics Chromjet Integrator
- 1 Perkin-Elmer 8500 GC equipped with
 - Photo-Ionization Detector
 - Hall 1000 Electrolytic Conductivity Detector
 - HS-101 Automatic Headspace Sampling Unit
 - Spectra-Physics SP-4290 integrator
- 1 Perkin Elmer Sigma 1B GC equipped with
 - 2 Flame Ionization Detectors
 - Thermal Conductivity Detector
 - Hewlett-Packard 3396A Integrator
 - Connected to Sigma 1B Data System
- 2 Spectra-Physics ChromStation Data Systems
- 4 PC Data Systems
- 1 Perkin Elmer Sigma Data Station

Metals Department

- 1 Thermo Jarrell Ash 61E Inductively Coupled Argon Plasma Emission Spectrometer equipped with IBM PS/2 Model 50Z Data-System
- 1 Perkin-Elmer Plasma II Inductively Coupled Argon Plasma Emission Spectrometer equipped with Perkin-Elmer Model 7500 Computer System Controller Perkin-Elmer PR-210 Color Printer As-51 Autosampler
- 2 Perkin-Elmer Zeeman 5100 Atomic Absorption Spectrophotometer equipped with EPSON EX-800 Printer Graphite Furnace AS-60 Autosampler EPSON Equity III Computer System HGA-600 Power Unit
- 1 Thermo Jarrell Ash Video 22 Smith-Hieftje Atomic Absorption Spectrophotometer equipped with Dual Channel Furnace Atomizer 188 TJA Autosampler NEC PowerMate 286/12 Computer NEC Pinwriter P3200
- 1 Perkin-Elmer Model 5000 Atomic Absorption Spectrophotometer equipped with Atomic Spectroscopy Data System 10 PR-100 Printer AS-40 Autosampler Graphite Furnace AS-50 Autosampler Automatic Burner Control
- 1 VG Plasmaguard II Inductively Coupled Argon Plasma Emission Spectrometer/Mass Spectrometer

Inorganics Department

- 2 Lachat QuikChem AC Automated Ion Analyzer equipped with
QuikChem AE Software System
Robotics Sampler
Digital Diluter -
Sampler Processing Module
Chloride - AE Chemistry
Nitrate and Nitrite - AE Chemistry
Sulfide - AE Chemistry
Fluoride - AE Chemistry
- 1 Waters Action Analyzer equipped with
Waters 600E System Controller
Waters 431 Conductivity Detector
Spectra-Physics SP-4400 Chromjet Integrator
- 1 Mitsubishi TOX-10 Organic Halogen Analyzer
- 1 Xertex Dohrmann TOC Analyzer with Sample Conditioning Module
- 1 Waters HPLC equipped with
Waters Lambda MAX Model 481 LC Spectrometer
Model 510 Solvent Deliver System
Differential Refractometer

Miscellaneous Laboratory Equipment

Milton Roy Spectronic 1201 Spectrometer
IEC HN-SII Centrifuge
Perkin-Elmer No. 1430 Ratio Recording Infrared Spectrometer
Bausch & Lomb Spectronic 21 Spectrometer
YSI Model 32 Conductance Meter
Fisher Model 447 Coulomatic K-F Titrimer
Fisher Model 805 MP pH/Mv meters (2)
Fisher Model 825 MP pH/Mv meter
ABC Laboratories Gel Permeation Chromatograph(Model Autoprep 1002A)
Market Forge Sterilmatic Autoclave
Millipore/Barnstead 18 Megohm RD/DI Water System
One Topaz Power Conditioner
Uninterruptable Power Supplies (5) - 100 KVA Total
Dohrmann 4-channel Absorption Modules (2)
DEM MDS MDS-81D Microwave Digestion System
Tekmar TSD-500 Sonic Disruption with dual horns
Glas-Col Model VS5504 8-position Floor Shaker
Eberbach Model 20-240 Variable Speed, Reciprocating shaker
Zymark Model ZW640-3 Turbovap Evaporators (2)

Balances

Fisher Model 2200 Analytical Balance
Fisher XT Analytical Balances (2)
Fisher XL-500 Analytical Balances (2)
Fisher XA Analytical Balance
Fisher XL-400 Analytical Balance
Mettler H54 AR Analytical Balance

Ovens/Furnaces

Fisher ISOTEMP 200 Series 255G Ovens (3)
Fisher ISOTEMP 501 Oven
Fisher ISOTEMP 500 Series Ovens (2)
WILT 24 cu. ft. Muffle Oven
Fisher ISOTEMP 3000 Series Model 350D Oven
Fisher ISOTEMP Model 497 Programmable Ashing Furnace
Fisher ISOTEMP Model 655G Model

Incubators

Fisher Model 307 Low Temperature Incubators (2)
Precision Coliform Incubators Bath
Fisher Model 146 Low Temperature Incubator

Miscellaneous Laboratory EquipmentRefrigerators/Coolers

Kenmore 6 cu. ft. refrigerators (10)
Goldstar 4.8 cu. ft. refrigerators (2)
Excellence 3.0 cu. ft. refrigerator
Puffer-Hubbard 6 cu. ft. Explosion-Proof Refrigerator
Whirlpool 19 cu. ft. refrigerators (2)
Whirlpool 16 cu. ft. refrigerator
Precision Model 813 Explosion-Proof Refrigerator
Welbilt 16 cu. ft. refrigerator
Perlick Stainless Three Door Commercial Cooler
Howard Stainless Single Door Commercial Cooler
W A Brown Walk-In Cooler (7x14)

Hoods

Labconco Protector 4 ft. Fume Hood
Labconco Protector 6 ft. Fume Hoods (3)
Labconco Protector 5 ft. Fume Hood with outside air make-up
Fisher 5 ft. Fume Hoods with outside air make-up
Fisher 6 ft. Fume Hoods with outside air make-up
Labconco Protector 3 ft. Fume Hoods (2)
Curtis Matheson 6 ft. Fume Hood

S. Chemicals and Reagents

The chemicals and reagents used by IEA are selected with extreme care. Solvents, chemicals and analytical standards are purchased in large quantities to minimize the number of reagent lots. Reagent lot numbers are recorded for every analytical batch processed.

"Analytical reagent grade" is the minimum quality used within the IEA laboratory. Ultra pure acids are employed for low detection limit metals analyses. Pesticide grade solvents are used for all organic extractions.

Each new lot of solvent is tested prior to acceptance for use in sample analysis. The extraction solvents are concentrated to duplicate the concentration employed by the extraction process and are analyzed as samples. Solvents used for the analysis of volatiles are analyzed using the same solvent volume and analytical technique used for samples. The acceptance criteria for new solvent lots are:

1. No analyte present at concentrations equal to or greater than one-half the reported quantitation limit.
2. No non-analyte peak present in the test chromatogram which is greater than 10% of the closest internal standard for GC/MS analyses or which would interfere in the identification and quantitation process for GC analyses.

IEA Document #QAS00400.NET describes the details of the solvent approval program and is available for review during a site audit.

Each lot of acid is tested prior to acceptance for use in sample analysis. A blank water sample is prepared for analysis using the new acid lot in the same manner used for sample analyses. For acceptance, a new acid lot must be proved to be free of all analytes at the reported quantitation limit.

Records showing the reagent lots employed are maintained for all analyses. The method blanks prepared for each set of samples serves as continual verification of the quality of the reagents as well as the quality of the total analytical environment.

All analytical standards are traceable to EPA certified standards. Each new lot of analytical standards is analyzed versus a corresponding standard obtained from the EPA. Both standards must be within 20 % of each other for the new analytical standard to be accepted for use by the laboratory. Relative response of the analytes in the standards is monitored by the production staff and by the QA Manager to ensure that the integrity of each analytical standard is maintained.

Attachment A

ATTACHMENT A

Summary of Drinking Water Methodologies utilized at IEA Laboratories, Cary, North Carolina

Analyte or Method	Description	Method#	Rel.	Matrix	Preservation
INORGANICS					
Alkalinity	Potentiometric	403	B	DW	#9
Calcium Hardness	EDTA Titrimetric ICP	216,2/200,7	A	DW	#9,#10
Fluoride	Ion Selective electrode	340,2	A	DW	None
Nitrate	Automated Cadmium reduction	303,2	A	DW	#11
Temperature	Thermometer	212	B	DW	None
Total Dissolved Solids	Gravimetric	160,1	A	DW	#9
pH	Potentiometric	160,1	A	DW	None

METALS					
Arsenic	AA Graphite furnace	306,2	A	DW	#10
Barium	ICP	200,7	A	DW	#10
Cadmium	ICP	200,7	A	DW	#10
Chromium	ICP	200,7	A	DW	#10
Cobalt	ICP	200,7	A	DW	#10
Lead	AA Graphite furnace	299,2	A	DW	#10
Manganese	ICP	200,7	A	DW	#10
Mercury	Manual Cold Vapor	346,1	A	DW	#10
Selenium	AA Graphite furnace	270,2	A	DW	#10
Silver	ICP	200,7	A	DW	#10
Sodium	AA Direct Aspiration	273,1	A	DW	#10

ORGANICS					
Chlorinated Hydrocarbons	Ext. GC	509A	B	DW	#9
Chlorophenols	Ext. deriv. GC	509B	B	DW	#9
Trihalomethanes	U/L Ext. GC	501,2	C	DW	#9,#12
VOCs	Purge and Trap, GC/MS	504,2	D	DW	#9,#13,#22
EDG and DBCP	Microextraction, GC	504	D	DW	#9,#12,#13

MICROBIOLOGY					
Total Coliform	Membrane filtration	800A & 808D	B	DW	#9
Total Coliform	Most Probable Number	809A	B	DW	#9

ATTACHMENT A -Continued...

Summary of Drinking Water Methodologies utilized at IEA Laboratories, Cary, North Carolina

Analysis or Method	Container Type	Holding Time		Initial Ctl	Method Blank	Quality Assurance Summary		
		Extraction	Analysis			Sample Duplicates	Matrix Spike	QC Check
INORGANICS								
Alkalinity	#14	-	14 days	#1	#5	#4	#21	#5
Calcium Hardness	#14	-	6 months	#1	#5	#4	#21	#5
Fluoride	#14	-	1 month	#1	#5	#4	#21	#5
Nitrate	#14	-	14 days	#1	#5	#4	#21	#5
Temperature	#14	-	None	-	-	-	-	-
Total Dissolved Solids	#14	-	7 days	-	#5	#4	-	#5
pH	#14	-	6 hours	#5	-	#4	-	#5

METALS								
Arsenic	#14	-	6 months	#1	#8	#4	#19	#5
Barium	#14	-	6 months	#2	#6	#4	#21	#5
Cadmium	#14	-	6 months	#1	#6	#4	#21	#5
Chromium	#14	-	6 months	#1	#6	#4	#21	#5
Copper	#14	-	6 months	#2	#6	#4	#21	#5
Lead	#14	-	6 months	#1	#6	#4	#21	#5
Manganese	#14	-	6 months	#2	#6	#4	#19	#5
Mercury	#15	-	30 days	#1	#6	#4	#21	#5
Selenium	#14	-	6 months	#1	#6	#4	#19	#5
Silver	#14	-	6 months	#2	#6	#4	#21	#5
Sodium	#14	-	6 months	#2	#6	#4	#21	#5

ORGANICS								
Chlorinated Hydrocarbons	#16	7 days	30 days (#7)	#3	#5	#4	#21	#5
Chlorophenols	#17	7 days	30 days (#7)	#3	#5	#4	#21	#5
Trihalomethanes	#18	-	14 days	#3	#5	#4	#21	#5
VOC's	#18	-	14 days	#3	#5	#4	#21	#5
ED8 and DBCP	#18	-	28 days	#3	#5	#4	#21	#5

MICROBIOLOGY								
Total Coliform	#14	-	30 hours	-	-	-	-	-
Total Coliform	#14	-	30 hours	-	-	-	-	-

Attachment B

IEPA Soil VOC Sampling and Decontamination Procedures



ATTACHMENT 7

Soil Volatile Sampling Procedures

Procedures:

- A. PREPARATION AND DECONTAMINATION OF SOIL SAMPLER (i.e. STAINLESS STEEL, BRASS, BRONZE, COPPER, etc.). An example of these samplers would be a Shelby tube, split-barrel sampler with metal tube inserts or California sampler. These are only examples there maybe more types available. Also, the sample tube must be at least six inches long.
- *1. Wash tubing or sampler with hot water and a nonfoaming detergent.
 2. Rinse with hot water.
 - *3. Rinse with a solvent, such as hexane or acetone.
 4. Rinse with very hot water to drive off solvent.
 5. Rinse with deionized distilled water.
 6. Air Dry
 7. Store the sampler in aluminum foil until ready for use.
- *Consult the laboratory for specific recommendations.

B. SOIL SAMPLING FOR VOLATILE ORGANICS

1. Using a properly decontaminated sampler (refer to preparation and decontamination instructions), push or drive the sampler to obtain a representative soil sample.
2. DO NOT remove sample from sample tube in the field. The laboratory should remove the sample from the sampling tube.
3. Immediately add clay or other cohesive material (i.e. wetted bentonite) to the ends of the sample to eliminate head space, if necessary.
4. Cover both ends of the sampler with aluminum foil. If possible, cover the aluminum foil with a cap.
5. Put the sample in storage at 4 degrees centigrade immediately.
6. Transport the samples to the laboratory as soon as possible. Most laboratories require delivery within 24 hours of sampling.

NOTE:

Soil samples which will be tested for volatile organic constituents cannot be composited because of the volatilization which would result from any compositing method.

Attachment C

IEPA Well Construction Report Format



Illinois Environmental Protection Agency

Well Completion Report

Site #: _____ County: _____ Well #: _____
Site Name: _____ Grid Coordinate: _____ Northing: _____ Easting: _____
Drilling Contractor: _____ Date Drilling Started: _____
Driller: _____ Geologist: _____ Date Completed: _____
Drilling Method: _____ Drilling Fluids Type: _____

Annular Space Details:

Elevations ____ .01 ft.

Type of Surface Seal: _____
Type of Annular Sealant: _____
Amount of Cement: # of Bags: _____ lbs. per bag
Amount of Bentonite: # of Bags: _____ lbs. per bag
Type of Bentonite Seal (Granular, Pellet): _____
Amount of Bentonite: # of Bags: _____ lbs. per bag
Type of Sand Pack: _____
Source of Sand: _____
Amount of Sand: # of Bags: _____ lbs. per bag

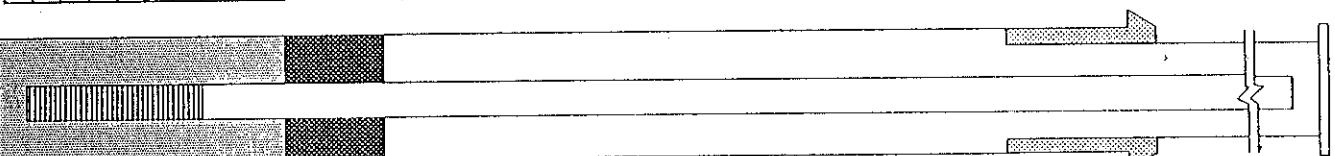
Well Construction Materials

	Stainless Steel Specify Type	Teflon Specify Type	PVC Specify Type	Other Specify Type
Riser coupling joint				
Riser pipe above w.t.				
Riser pipe below w.t.				
Screen				
Coupling joint screen or riser				
Protective casing				

Measurements

to .01 ft. (where applicable)

Riser pipe length	
Protective casing length	
Screen length	
Bottom of screen to end cap	
Top of screen to first joint	
Total length of casing	
Screen slot size	
of openings in screen	
diameter of borehole (in)	
ID of riser pipe (in)	



ft. MSL Top of Protective Casing
ft. MSL Top of Riser Pipe
ft. Casing Stickup
ft. MSL Ground Surface
ft. Top of annular sealant
ft. Top of Seal
ft. Total Seal Interval
ft. Top of Sand
ft. Top of Screen
ft. Total Screen Interval
ft. Bottom of Screen
ft. Bottom of Borehole

Completed by: _____

Surveyed by: _____

Ill registration # _____

Attachment D

**IEPA Groundwater Sampling Procedures
(excerpt from September 23, 1993 IEPA Qualified Approval Letter
to the May, 1993 Phase I RFI Workplan)**

ge 11

a new survey of the old and new wells must be collected. On page 14 it is stated that all wells will be set to a depth of 10 feet below ground surface. Although consistency is desired, the anticipated depth shall be adjusted as field conditions warrant such adjustment.

- h. Stainless steel used in the construction of the monitoring wells shall be of Schedule 316.

- i. All monitoring wells or piezometers completed above ground and located in high traffic areas must be protected by bumper guards.

- j. Well development shall continue until field parameters, specific conductance, pH, turbidity and temperature, stabilize provided a minimum of three well volumes are removed.

- k. All soil borings, soil cuttings, purged groundwater from well sampling or purging, equipment decontamination wash and rinsates, etc., must be containerized and managed as hazardous waste unless proven non-hazardous in accordance with 35 IAC 721.103(c) and (d). SKC-CRC, being considered the generator of these wastes, must adequately classify these wastes as either hazardous or non-hazardous. In any event, these materials must be managed as special wastes.

- l. Quarterly reports shall be submitted in accordance with the following schedule (NOTE: The groundwater monitoring wells must be installed so that samples can be collected during either October 1993 or November 1993):

Sampling Event Phase I	Samples to be Collected During the Months of	Results Submitted to the Agency by the Following
First Quarter	October - November	January 15
Second Quarter	January - February	April 15
Third Quarter	April - May	July 15
Fourth Quarter	July - August	October 15

- m. Prior to purging a well for sample collection, the potential presence of an immiscible liquid must be evaluated. This evaluation must be in accordance with the procedures set forth on pages 7.6 and 7.7 of the RCRA Ground-Water Monitoring: DRAFT Technical Guidance, November 1992 (EPA/530-R-93-001).

- n. The order of sample collection shall proceed as follows:

- i. Volatile organics (VOAs or VOCs) and total organic halogens (TOX);

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- ii. Dissolved gases and total organic carbon (TOC);
- iii. Semivolatile organics (SMVs or SVOCs);
- iv. Metals and cyanide;
- v. Major water quality cations and anions; and
- vi. Radionuclides.
- o. Electronic water level indicators or steel measuring tapes used to collect static water levels shall be dedicated or disposable or be decontaminated in accordance with the workplan and any modifications made herein.
- p. Since the Phase I investigation of the RFI is to determine whether contamination exists, the slug tests proposed are not a required portion of this phase. Therefore, if SKC-CRC obtains hydraulic conductivities using wells screened across two dissimilar saturated zones, the data obtained will be considered preliminary only. The Agency may require more extensive and discreet hydraulic conductivity testing during any Phase II investigation.
- q. Use of the Bouwer and Rice method to analyze data from the proposed slug tests to obtain composite hydraulic conductivities appears to be inappropriate. The method proposed assumes homogeneous and isotropic conditions which do not correspond with field observations. Therefore, if these slug tests are to be conducted, an appropriate method of analysis or an adequate explanation of the appropriateness of the Bouwer and Rice method shall be proposed to the Agency by October 31, 1993.
- r. All sample forms, chain of custody forms, maintenance and calibration records shall be submitted with the appropriate quarterly groundwater sampling report.
- s. All data will be presented in both raw form and in sorted or organized formats in the quarterly groundwater reports.
- t. All equipment which is in contact with groundwater, including equipment used to evacuate a well, collect a sample or conduct a slug test, shall be constructed of stainless steel or inert materials.
- u. The following information requirements shall be added, if they are not already included, to the Field Log Book:
 - i. Detection of immiscible liquids;
 - ii. Order of the collection of samples;

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- iii. Internal temperature of field and shipping containers;
- iv. Weather conditions;
- v. Static water level;
- vi. Parameters; and
- vii. Purging procedures and equipment.
- v. The following information requirements shall be added, if they are not already included, to the chain of custody forms:
 - i. Total number of containers;
 - ii. Signature of collector;
 - iii. Inclusive date and times of possession;
 - iv. Internal temperature when packing; and
 - v. Internal temperature upon arrival.
- w. Samples shall be analyzed using SW-846 methods with detection limits at least as low as the PQLs listed for the particular method in 35 IAC 724 Appendix I.
- x. Decontamination procedures shall be in accordance with the RCRA Ground-Water Monitoring: DRAFT Technical Guidance, November 1992 (EPA/530-R-93-001) and are as follows:
 - 1. The following cleaning procedure shall be used when organic constituents are the analytes of interest [if acetone, hexane or methanol are analytes of interest, a different solvent (which is not a target analyte) should be chosen (e.g., isopropanol).]:
 - a. Wash the equipment with a nonphosphate detergent.
 - b. Rinse the equipment with tap water.
 - c. Rinse the equipment with pesticide-grade hexane or methanol (methyl alcohol).
 - d. Rinse the equipment with reagent grade acetone.
 - e. Rinse the equipment with organic-free reagent water.

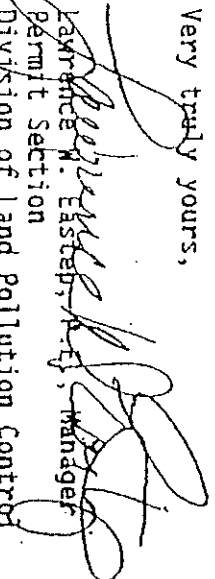
Page 14

2. The following cleaning procedure shall be used when inorganic constituents are the analytes of interest:
 - a. Wash the equipment with a nonphosphate detergent.
 - b. Rinse the equipment with tap water.
 - c. Rinse the equipment with dilute (0.1N) hydrochloric acid.
 - d. Rinse the equipment with reagent water.
3. If potable water is used as the last step in any decontamination, the sampling/purging equipment must be further rinsed with distilled/deionized water or an analysis of the potable water must be included with the groundwater sampling results.
- y. Monitoring well construction shall conform to the Agency Monitoring Well Construction diagram attached.

23. This letter shall serve as final Agency action on the subject submittal. As such, this action is subject to the appeal provisions of Sections 39 and 40 of the Illinois Environmental Protection Act.

Should you have any questions regarding this matter, please contact Michael A. Heaton at 217/524-3312 or Heather K. Young at 217/524-3290.

Very truly yours,


Lawrence M. Eastep, P.E., Manager
Permit Section
Division of Land Pollution Control
Bureau of Land

LWE:MH:sf/sp/634Y,1-14
JCL

Attachments: RFI Phase I Certification
RFI Phase I Laboratory Certification Statement
Agency Monitoring Well Construction Diagram
Well Completion Forms
Attachment 7

cc: USEPA Region V -- George Hamper (w/o att.)

Attachment E

**Decontamination Procedures for Groundwater Sampling
(excerpt from the November, 1992 RCRA Groundwater Monitoring
DRAFT Technical Guidance, EPA/530-R-93-001)**

EPA/530-R-93-001

PB93-139350



RCRA GROUND-WATER MONITORING: DRAFT TECHNICAL GUIDANCE

OFFICE OF SOLID WASTE
U.S. ENVIRONMENTAL PROTECTION AGENCY
401 M STREET, S.W.
WASHINGTON, D.C. 20460

NOVEMBER 1992

This document is distributed by the USEPA to update technical information contained in other sources of USEPA guidance, such as Chapter Eleven of SW-846 (Revision 0, September 1986) and the Technical Enforcement Guidance Document (TEGD).

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U.S. DEPARTMENT OF COMMERCE
NATIONAL TECHNICAL
INFORMATION SERVICE
SPRINGFIELD, VA 22161

contamination; also, the pump can be difficult to clean. Gas-drive pumps are not recommended for sampling monitoring wells.

7.3.3 Packer Assemblages

A packer assembly provides a means by which to isolate and sample a discrete interval in the subsurface. Hydraulic- or pneumatic-activated packers are wedged against the casing wall or screen allowing sample collection from an isolated portion of the well. The packers deflate for vertical movement within the well and inflate when the desired depth is attained. Packers are usually constructed from some type of rubber or rubber compound and can be used with submersible, gas-lift, and suction pumps.

If pumps are operated at a low rate, a packer assembly allows sampling of low-yielding wells, and wells that would otherwise produce turbid samples. A number of different samplers can be placed within the packers depending upon the analytical specifications for sample testing. One disadvantage is that vertical movement of water outside the well is possible with packer assemblages, depending upon the pumping rate and formation properties. Another possible disadvantage is that the packer material may be chemically reactive, causing gain or loss of organic contaminants through sorption or desorption.

7.3.4 Decontaminating Sampling Equipment

When dedicated equipment is not used for sampling (or well purging) or when dedicated equipment is stored outside of the well, the owner/operator's QAPJP should include procedures for disassembly and cleaning of equipment before each use at each well.

The recommended cleaning procedure for sampling equipment used when organic constituents are of interest is as follows (Barcelona et al., 1990; Keeley and Boateng, 1987; USEPA, 1986a):

1. Wash the equipment with a nonphosphate detergent.
2. Rinse the equipment with tap water.
3. Rinse the equipment with pesticide-grade hexane or methanol (methyl alcohol).
4. Rinse the equipment with reagent grade acetone.
5. Rinse the equipment with organic-free reagent water.

If acetone, hexane, or methanol are analytes of interest, a different solvent (which is not a target analyte) should be chosen (e.g., isopropanol).

The recommended cleaning procedure for sampling equipment used when inorganic constituents are of interest is as follows (Barcelona et al., 1990; Keeley and Boateng, 1987; USEPA, 1986a):

1. Wash the equipment with a nonphosphate detergent.
2. Rinse the equipment with tap water.
3. Rinse the equipment with dilute (0.1N) hydrochloric or nitric acid.
4. Rinse the equipment with reagent water.

Dilute hydrochloric acid is preferred over nitric acid when cleaning stainless steel because nitric acid may oxidize the steel.

In all cases, waste decontamination fluids should be containerized until the investigators determine (e.g., through analytical testing) whether the fluids should be treated or disposed of as hazardous waste.

All equipment should be allowed to dry thoroughly in a dust-free environment. If the equipment is not to be used again immediately, it should be packaged and properly stored to protect it from dust and dirt. Equipment may be wrapped in aluminum foil (shiny side on the outside) and placed in a plastic bag. A label should be affixed to the outside wrapping summarizing the decontamination procedure and stating the date of decontamination. Decontaminated sampling equipment should not be placed on the ground or on other contaminated surfaces prior to insertion in the well.

7.3.5 Collecting Ground-Water Samples

Monitoring well sampling should always progress from the well that is expected to be least contaminated to the well that is expected to be most contaminated, to minimize the potential for cross-contamination of samples that may result from inadequate decontamination of sampling equipment. Samples should be collected and containerized according to the volatility of the target analytes. The preferred collection order for some of the more common ground-water analytes is as follows (Barcelona et al., 1985b):

1. Volatile organics (VOAs or VOCs) and total organic halogens (TOX);
2. Dissolved gases and total organic carbon (TOC);
3. Semivolatile organics (SMVs or SVOCs);
4. Metals and cyanide;

Attachment F

EPA Guidance for Demonstrating Groundwater is Class II Groundwater

DRAFT

APPENDIX D
GUIDANCE FOR DEMONSTRATING GROUNDWATER IS CLASS II GROUNDWATER

Introduction

The Illinois Pollution Control Board adopted the Groundwater Quality Standards at 35 IAC Code 620, in November 1991. Included in this rulemaking are criteria for classifying groundwaters for purposes of determining the appropriate level of protection (i.e. determining the appropriate quality standards which the groundwater should meet). Unless site-specific information demonstrates otherwise, the Bureau of Land presumes that all groundwater beneath a facility must meet Class I quality standards in 35 IAC 620 (the most stringent standards). The reason for this is that the Agency must take a conservative approach in ensuring that the quality of groundwater beneath a facility is adequately protected. This document has been developed to provide guidance to facilities regarding the type of information which should be provided to the Agency to demonstrate that groundwater beneath a facility is subject to the Class II groundwater quality standards. The class of a groundwater is independent of its actual quality, except for certain Class IV groundwater.

Definition of Class II Groundwater

Groundwater is classified in 35 IAC 620 as a Class II, general resource, groundwater when it:

1. Does not meet the provisions of 35 IAC 620.210 (Class I groundwater), 35 IAC 620.230 (Class III) or 35 IAC 620.240 (Class IV). (Determining whether the groundwater is Class III or Class IV is relatively straight forward, as is the requirement to determine if the groundwater has previously been classified as Class II groundwater by the Board). Determining that a groundwater is not a Class I groundwater is somewhat complex and is further discussed in the following section.
2. Has been found by the Board to be a Class II groundwater, pursuant to the petition procedures set forth in 35 IAC 620.260; (If a continuous zone containing groundwater begins within 10 feet of the ground surface and extends greater than ten feet below the ground surface it will not be considered a Class II groundwater if an additional criteria is met under 620.210, in this case it would be considered Class I groundwater. Although it may be possible, it is unrealistic to try and designate two distinct classes of groundwater within the same saturated hydrogeologic unit. But, if a facility can demonstrate that by cleaning the groundwater within ten feet of the surface to Class II specifications will not degrade the groundwater greater than 10 feet below the Agency may approve both Class I standards, the Agency may approve both Class I and II standards in accordance with the location of the groundwater); or
3. Is located less than ten feet below the ground surface (See also discussion in Item 2 above).

Demonstrating a Groundwater is a Class II Groundwater

Initially, the following should be reviewed to determine the appropriate classification of groundwater of a site: (1) published data concerning regional and local geologic and hydrogeologic conditions (i.e. geologic surveys, former site investigations, etc.); (2) the locations of all potable water wells located within one mile of the site with the logs and/or dates of well completion attached; and (3) available on site boring logs which characterize the geology from ground surface to the first saturated unit or, if a perched zone is present, the first saturated unit below the perched zone. A review of this information may clearly indicate that the groundwater of concern is a Class I, III or IV groundwater and thus would not be Class II groundwater.

If it appears as though, based on the general information gathered as discussed above, the groundwater of concern may only be a Class II groundwater then additional efforts must be carried to demonstrate conclusively that the groundwater is indeed Class II groundwater. The information which should thus be compiled and submitted to the Agency to demonstrate that a given groundwater is Class II groundwater includes the following (NOTE: If the information identified below has previously been submitted to the Agency, then one need only reference the document name, date it was submitted, and page(s) of the document on which the information is located):

1. Background information regarding the facility's operations;
2. A scaled drawing showing the location of the facility;
3. The discussion of the reason why it is necessary to classify the groundwater of concern at the facility;
4. A description of any remedial actions being carried out at the facility;
5. The results of the review of existing general information regarding the geology/hydrogeology of the facility and surrounding area as discussed above.
6. A description of the on-site geology and hydrogeology, including a description of the groundwater which is being classified and the geologic formation in which the groundwater is located. This description should be developed in accordance with the guidance set forth in the TEGD.
7. Information indicating that the groundwater of concern is not a Class III groundwater (see 35 IAC 620.230) or a Class IV groundwater.
8. Information, as appropriate, indicating that the groundwater has already been determined to be Class II groundwater by the Illinois Pollution Control Board as allowed by 35 IAC 620.260.
9. Information indicating that the groundwater is less than 10' below the groundwater surface. (If a continuous zone containing groundwater begins within 10 feet of the ground surface and extends greater than ten feet below the ground surface it will not be considered a Class II groundwater if an additional criteria is met under 620.210, in this case it would be considered Class I groundwater. Although it may be possible, it is

unrealistic to try and designate two distinct classes of groundwater within the same saturated hydrogeologic unit. But, if a facility can demonstrate that by cleaning the groundwater within ten feet of the surface to Class II specifications will not degrade the groundwater greater than 10 feet below the Agency may approve both Class I standards, the Agency may approve both Class I and II standards in accordance with the location of the groundwater); or

10. Information demonstrating that the groundwater is not Class I groundwater as defined in 35 IAC 620.210. This demonstration can be made by addressing the following (note that to be a Class II groundwater, a demonstration must be made that the groundwater does not meet any of the five criteria for Class I groundwater described below):

- a. Groundwater located within the minimum setback of a well which serves as a potable water supply and to the bottom of such well Class I groundwater. The minimum setback zone of a well extends from the land surface to the bottom of the well as determined by the screen depth. This establishes a three-dimensional zone of protection around the well. Section 14.1 of the Environmental Protection Act establishes minimum setbacks of less than 200 feet for a private water supply well or less than 400 feet for a public water supply well unless the specified minimum setbacks have been expanded under the Wellhead Protection Program and the Illinois Groundwater Protection Act. Thus information must be provided demonstrating that the groundwater of concern does not meet this criterion for Class I groundwater.

This issue can be addressed by submitting a scaled map delineating the site and all potable water wells located within a one mile radius from the unit/s of concern. The Illinois State Water Survey and/or the Division of Public Water Supplies of the Illinois Environmental Protection Agency should be contacted, as well as other appropriate state and federal entities, to obtain this information. A copy of the state or federal agencies response to an information inquiry should be included with the information submitted by the facility. Also, a visual inspection of the area within 200 feet of the unit/s of concern should be conducted when possible to detect unlogged private wells.

- b. Groundwater in formations beneath in a facility which consist of unconsolidated sand, gravel or sand and gravel which is 5 feet or more in thickness and that contains 12 percent or less in fines (i.e. fines which pass through a No. 200 sieve tested according to ASTM Standard Practice D2488-84, incorporated by reference at Section 620.125) is Class I groundwater. Thus, if a facility desires to have groundwater beneath its facility to be classified as a Class II groundwater, it must submit information that the groundwater does not meet this criterion for Class I groundwater.

This criterion is specific to the type formations listed. If a zone of saturation fails this Class I criterion, Class I may still apply pursuant to (d) or (e) below. This criterion may be

satisfied by the submission of, at a minimum, one site specific, continuously sampled boring log which clearly identifies the saturated interval from which a representative sample was obtained. Sieve test analysis should be conducted on several samples from each saturated interval which is at least five feet in thickness and composed of sand sized grains or greater. In addition, the facility should submit the sieve data sheet, plot and a scaled map which identifies the location of each boring.

- c. Groundwater in sandstone which is 10 feet or more in thickness, or fractured carbonate which is 15 feet or more in thickness is Class I groundwater. Thus, to demonstrate a groundwater is Class II groundwater, information must be provided to demonstrate that the groundwater in question does not meet this criterion for Class I groundwater.

This demonstration may be made by the submission of, at a minimum, one site specific, continuously sampled boring log with a description of the geologic material present. This boring log should extend from the ground surface to a depth which is 10 feet to the uppermost water-bearing unit subject to Class I standards or bedrock, whichever is shallower. The boring(s) should be continuously sampled and located on a scaled site map. A representative sample, as used previously, is a sample obtained from each distinctive saturated unit within the boring. Also, a literature search of regional and local geologic conditions should be conducted with the results submitted to the Agency.

- d. Groundwater in a geologic material which is capable of a sustained groundwater yield, from up to a 12 inch borehole, of 150 gallons per day or more from a thickness of 15 feet or less is Class I groundwater. Thus, a demonstration that a given groundwater is Class II groundwater must contain a demonstration that the groundwater in question does not meet this criterion for Class I groundwater.

This demonstration can be made by the submission of continuously sampled boring logs which demonstrate aquifer thickness. In addition, as-built well construction diagrams should also be submitted to the Agency for review. Furthermore, a pump test or equivalent must be conducted to determine the yield of the geologic material. methodology, assumptions and any calculations performed should also be submitted to meet this requirement. If the aquifer geometry and transmissivity have been obtained through a site-specific field investigations, an analytical solution may be used to estimate well yield. The facility must demonstrate the appropriateness of an analytical solution to estimate well yield versus an actual field test. Well yield should be determined for either confined or unconfined.

- e. Groundwater in a geologic which has a hydraulic conductivity of 1×10^{-4} cm/sec or greater is Class I groundwater. Thus, a demonstration that a given groundwater is Class II groundwater must

contain a demonstration that the groundwater in question does not meet this criterion for Class I groundwater.

This demonstration can be made by performing field and/or lab tests such as a permeameter, slug test and/or pump test. An appropriate method of evaluation should be chosen based on the type of wells, the length of time over which data may need to be collected and, if known, the characteristics of the targeted aquifer. Such test methods and the suggested information to be submitted to the Agency include (note that any of the three method can be used):

- i. Permeameter. If this method is chosen, samples of unconsolidated materials should be left in the field-sampling tubes which then becomes the permeameter sample chamber. Proceeding in this manner should allow as little disruption to the sample as possible. Unconsolidated samples should not be repacked into the sample chamber. An outline of the laboratory test method used and a description of the steps followed including any calculations should be submitted to the Agency for review.
- ii. Slug tests. The information to be submitted to the Agency should include a description of the slug test method utilized and a discussion of the procedures followed during the tests, including any calculations performed.

A significant drawback to performing a slug test is that it is heavily dependent on a high-quality intake. If a well point is clogged or corroded, measured values may be inaccurate. Also, if a well is developed by surging or backwashing prior to testing, the measured values may reflect increased conductivities in the artificially induced gravel pack around the intake (Freeze and Cherry, 1979). If slug tests are chosen, a sufficient number of tests should be run to ensure that representative measures of hydraulic conductivities have been obtained and that lateral variations at various depths are documented (TEGD, 1986).

- iii. Pump tests. Preliminary or short-term drawdown tests should be performed initially to assess the appropriate pumping rate for the constant-rate tests. Several methods and/or equations may be used in evaluating data generated from pump tests such as Theis, Hantush-Jacob, Hvorslev and/or Theim equations. The method(s) of evaluation selected should be provided to the Agency with justification for their use, explanations of any assumptions made and examples of all calculations performed along with a description of the physical tests performed including the type of pump used.

Two problems that should be considered are (1) storage of potentially contaminated water pumped from the well system and (2) potential effects of groundwater pumping on

existing waste plumes (TEGD, 1986). Any groundwater pumped from wells in an area where there is a potential for contamination during either a yield test or hydraulic conductivity test should be containerized and tested to determine whether its contents would be a special waste. This will aid the facility in determining whether any special permits are needed for disposing of the groundwater properly. Caution should be used when performing groundwater yield tests for extended periods of time, so that any contaminant plume present or suspected is not significantly altered.

NOTE REGARDING PERMEABILITY TESTING: It may be beneficial to use laboratory evaluation methods to further support results of field tests; however, field methods provide the best definition of the hydraulic conductivity in most cases (TEGD, 1986). The most appropriate method to determine hydraulic conductivity for most sites will be the pump test provided proper evaluation of the data obtained from the test utilized. Pump tests provide in-situ measurements that are averaged over a large aquifer volume and are preferred since they are able to characterize a greater portion of the subsurface compared to the other aquifer tests. Slug tests provide in-situ values representative of a small volume of porous media in the immediate vicinity of a piezometer tip, providing point values only, and may be more appropriate in very low-permeability materials in which conductivity is too small to conduct a pump test.

REFERENCES:

- USEPA, 1986, RCRA Groundwater Monitoring Technical Enforcement Guidance Document (TEGD), OSWER - 9950.1
- Freeze and Cherry, Groundwater, 1979, Prentice-Hall, Inc., Englewood Cliffs, NJ

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GROUNDWATER CLASSIFICATION

Is the portion of the geologic material containing water located after 10 ft below the ground surface?

No

Class II

*See Board interpretation on the "10' rule" on Page 12 of rulemaking R89-14(B)

Yes**

**For each zone of saturated geologic material to a depth which is 10' into the uppermost water-bearing unit subject to Class I standards or bedrock, whichever is shallower, the following must be evaluated.

Is the geologic material a well documented potable resource groundwater/aquifer?

Yes

Class I

No

Yes

Class I

Is the groundwater in geologic material located within the minimum setback of a well?

No

On-site boring logs which characterize the geology of the saturated zone of interest must be obtained.

Is the geologic material a sandstone 10 ft or more in thickness or a fractured carbonate 15 ft or more in thickness?

Yes

Class I

No

Is the geologic material on unconsolidated sand, gravel or sand and gravel 5 ft or more in thickness?

Yes

Class I

No

Does it contain 12% or less of fines?

Yes

Class I

***Multiple representative samples obtained from the geologic material beneath the facility must fail to meet this criteria

Is the geologic material capable of a sustained groundwater yield of 150 gallons per day or more from a thickness of 15 ft or less?

Yes

Class I

No

Is the hydraulic conductivity of the geologic material greater than 1×10^{-4} cm/sec using either a permeameter, slug test or pump test?

Yes

Class I

No

Class II

Attachment G
Certification Forms

Safety-Kleen Corp. - CRC
RFI Phase II Report

Log No. B-121

Upon completion of Phase II of the RFI, this statement is to be completed by both a responsible officer of the owner or operator (as defined in 35 IAC 702.126) and by the registered professional engineer overseeing all work associated with the investigation. Submit one copy of the certification with original signatures and three additional copies.

RFI Phase II activities at the facility described in the RFI Phase II Workplan have been completed in accordance with the specifications in the approved RFI Workplan. I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

<u>U.S. EPA ID Number</u>	<u>Facility Name</u>
<u>Signature of Owner/Operator</u>	<u>Name and Title</u>
<u>Signature of Registered P.E.</u>	<u>Name of Registered P.E. and Illinois Registration Number</u>
<u>Mailing Address of P.E.:</u>	<u>Registered P.E.'s Seal:</u>

Safety-Kleen Corp. - CRC
RFI Phase II Report
Laboratory Certification
Log No. B-121

Upon completion of Phase II of the RFI, this statement is to be completed by both a responsible officer of the owner or operator (as defined in 35 IAC 702.126) and (2) a responsible officer (as defined in 35 IAC 1702.126) of the laboratory which conducted the chemical analyses required as part of Phase II of the RFI. The original of this statement shall accompany the original certification statement for the overall Phase II activities and the RFI Phase II Report.

The applicable sample collection, handling, preservation, preparation and analysis conducted as part of Phase II of the RFI at the facility described in this document that the chemical laboratory was responsible for has been conducted in accordance with the specifications in the approved workplan. I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

<u>U.S. EPA ID Number</u>	<u>Facility Name</u>
<u>Signature of Owner/Operator</u>	<u>Name and Title of Owner/Operator Representative</u>
<u>Date</u>	<u>Date</u>
<u>Name of Laboratory</u>	<u>Signature of Laboratory Responsible Officer</u>
	<u>Name and Title of Laboratory Responsible Officer</u>
<u>Mailing Address of Laboratory:</u>	